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FIG. 1.—Titanic "Memorial," by Mrs. Harry Payne Whitney.

INDIVIDUAL GYMNASTICS

A HANDBOOK OF CORRECTIVE AND REMEDIAL GYMNASTICS

BY

LILLIAN CURTIS DREW

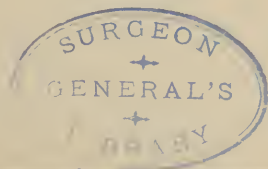
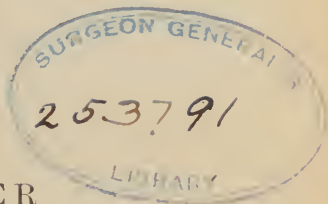
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UNIVERSITY, NEW YORK CITY; INSTRUCTOR IN
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DIRECTION OF DR. E. H. BRADFORD,
BOSTON, AND DR. E. G. BRACKETT,
BOSTON, MASS.

SECOND EDITION, THOROUGHLY REVISED

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PREFACE.

THE author's experience in individual gymnastics has been such as to justify the belief that there exists at the present time the need of a book which shall clearly and correctly present, to those who are interested in physical education, the causes and treatment of certain physical defects.

By reason of these physical abnormalities or of some inefficiency in the individuals under the supervision of teachers in this line of work, puzzling problems frequently arise which necessitate, or at least make advisable, certain changes or modifications of the regular gymnastic lesson. The substitution in such cases of individual gymnastics, or their use as an adjunct to work with the group in the gymnasium, has been a matter to which the author has given careful thought and exhaustive study. This book, based upon the experiences of many years, has been written for the purpose of meeting needs evident, in cases of the above character, by suggesting the most practical and helpful way of bringing about results in individual emergencies.

The recognition of such conditions and the ability to deal with them intelligently are within the province of every teacher of physical education.

The importance of these matters cannot be overestimated.

Abnormal conditions of most frequent occurrence are analyzed, their causes discussed and attention directed to lines of procedure for prevention and improvement. Considerable space has also been given to the description and application of exercises, the illustrations for which were drawn from life by Miss Margaret Robertson.

The author sincerely hopes that this book will accomplish the purposes for which it is intended. It is submitted to those who have made work of this kind a study and practice; to all teachers and students of physical education, and also to others interested in the solution of the many difficult problems on which the writer has endeavored to shed some light in this short treatise.

L. C. D.

NEW YORK, 1923.

FOREWORD.

THE role that is played by properly applied corrective and developmental gymnastic work is an important one in the hygiene of modern life, and particularly modern urban life. A book which calls attention to this form of therapy is particularly welcome, and especially so now, since during the past few years, emphasis has been necessarily placed on its closely associated ally, in the various forms of physiotherapy. The value of preventive and corrective physical aids in the developmental periods of youth, and the definite benefit which follows the employment of the corrective forms of exercise, in the strenuous life of the ordinary individual, place this feature of therapy, viz., individual gymnastics in a forerank of importance.

The author has indicated the proper relation which the gymnastic and the corrective exercises bear to the practice of medicine. The position is assumed that, as the application of all medical remedial agencies are a part of the practice of medicine, they should be under its general medical guidance. It is sometimes more practical, and it is frequently necessary, that the direction, and often the prescription, of gymnastic exercises should be under the guidance of the properly trained physical instructor, who must use his judgment and knowledge in the application of the remedial forces, in the use of which he is trained, in order to obtain a given end. For the help of such, the author has pre-

sented practical and safe advice and has marked out the right course to follow in these somewhat troublous waters. The student in this department of work can be guided in a course which will allow initiative in his own special department of therapy, and yet keep in touch with the medical profession, for the necessary knowledge and direction that is necessary to treat pathological conditions.

The author has been able to bring to this work a rather unusual and varied knowledge, obtained on the one hand, from the experience of personal contact with a very large number of individuals, and on the other hand, from the experience of a contact with large groups, both in treating and in teaching, and in consequence has learned to know what is most needed by students of this form of therapy, and how to best present it to them. The importance of this feature cannot be overemphasized, for in this field so closely allied to the practice of medicine, the preservation of the personal element is most important, in order to obtain coöperation and the best results. The material in this work has been particularly well divided, and the subjects so presented as to facilitate the study of each one as desired.

E. G. BRACKETT,
Boston.

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INDIVIDUAL GYMNASTICS.

CHAPTER I.

INDIVIDUAL GYMNASTICS: ITS PLACE IN PHYSICAL EDUCATION. CONDITIONS FOR WHICH IT IS ADVISABLE.

THE PLACE OF INDIVIDUAL GYMNASTICS IN PHYSICAL EDUCATION.

PHYSICAL education is the all-around training whereby the potential possibilities of an individual may be developed to a high degree—not alone the physical, but mental and spiritual as well. Its object is the attainment of a well-adjusted and coördinated organism—a controlled mind and body, which may best meet all situations in life. Health, strength, skill and beauty are the physical by-products.

Bodily activities of various types are some of the tools by which this goal may be achieved. These activities may be classified into two groups, though allied in their aim, for the development of the individual to the utmost of his capacity.

In the first group may be included gymnastic exercises, dancing, plays, games and sports. It is not the purpose to enter into a discussion of this group at this time, but to direct attention to the other branch, that of medical gymnastics. Medical gymnastics comprises exercises based

on anatomical and physiological principles, performed by the individual alone or with assistance, for the prevention or arrest, the cure or correction of some definite functional or organic disability or deformity.

These exercises should never be undertaken by an inexperienced person without proper guidance or instruction. To the same extent as the physician who prescribes medicine, the true teacher of medical gymnastics assumes responsibility for prescribing exercises, and should, therefore, have medical training as a basis for its intelligent and safe application. In the absence of such training, however, work may be done under a physician who understands the conditions and directs the treatment.

It is interesting to trace the *history of medical gymnastics* and to note that it seems to have had its beginning almost with the history of man. The earlier civilization exhibited an instinctive appreciation of the value of exercise. It was not, of course, what is now known as medical gymnastics—a carefully graded system—but some sort of exercise for remedial purposes has been in use from earliest times. Primitive man seems to have recognized that certain bodily ailments were benefited by physical activity.

Records and pictures have been found representing the use of medical gymnastics by the Chinese, at least three thousand years B.C. One old record states that “gymnastic exercises stimulate bodily fluids to an even motion, which constitutes a condition of health. This motion is facilitated by the lying position and impeded by the upright position.”

Exercises and manipulations have been used in the same connection by Egyptians, Hindus and other Eastern nations for many centuries, and were a part of the stock in trade of the priesthood, who were the medical men of earlier times. The Greeks and Romans employed exercise for its beneficial

effect quite universally, and Asclepiades and Celsus, at about the beginning of the Christian Era, prescribed exercise for the cure of many diseases, and for counteracting the effect of the effeminate luxury of the Romans. The importance of exercise in its effect upon mental states, which today is considered one of its most desirable results, was recognized by Pliny, whose philosophy has sent this message through the ages, "The mind is stimulated by movements of the body."

During the Middle Ages we are able to trace its use also, and it began to grow in importance, especially in the Sixteenth and Seventeenth Centuries. And so down the centuries to the present time, medical gymnastics has occupied a definite place as a therapeutic agent. The Swedish system was formulated early in the Nineteenth Century by Dr. P. H. Ling. This is a carefully chosen collection of exercises, based on anatomical and physiological principles, and is very generally used.

For greater convenience and to facilitate its study, medical gymnastics may be subdivided into two parts:

1. When it is applied to what may be called medical conditions the term "remedial" is used.
2. When it is applied to orthopaedic conditions, or those of impending or existing deformity, it has been designated as "corrective gymnastics."

The word "orthopaedic," from two Greek words—*orthos*, right; *paidos*, child—originally embodied the idea of the correction of deformities of children. It has now come, however, to have a broader application and to include the consideration of alterations in the symmetry and proper adjustment of the body structure, both of children and adults. The most common of these abnormalities which come under the observation of the teacher of physical education may be grouped as follows:

1. Anteroposterior faulty postures. Deviations from the properly adjusted body in the plane from front to back, known as the anteroposterior.

2. Scoliosis, or lateral curvature of the spine.

3. Abnormalities of the feet.

Conditions such as bow-legs, knock-knee, deformities resulting from infantile paralysis, and others may be observed; but as these are almost entirely within the province of the orthopaedic surgeon, they should be referred to him for diagnosis and subsequent treatment. However, it is of the utmost importance that teachers of physical education should be able not only to recognize these conditions but also to grasp understandingly their character and degree. Care must always be taken that the teacher shall keep within the limits of the profession and not trespass upon the medical or surgical field for which he or she has not been trained.

Besides the improvement by corrective exercises of what have been characterized as orthopaedic conditions, the teacher should for various reasons, be prepared to meet other needs of individuals for special rather than class work. This will be the experience especially of those who are teaching older girls or college women. Pupils exhibiting conditions such as poor circulation, anemia, ptosis, sluggish digestion, constipation, general low vitality, nervous instability, disturbances of the menstrual function, and insufficient breathing should be excused from regular class gymnastics, but they should not be denied thereby the benefits of exercise. A program of individual exercises should be substituted.

As little emphasis as possible should be laid upon the fact that the pupil exhibits an abnormal condition; that he has been segregated from his companions in order that

he may be "corrected." The term "corrective" has too often been a stigma, and has a tendency to cause introspection, morbidity and self-consciousness—most undesirable concomitants. While it is essential, to some extent, to direct attention to definite purposes, it must be done carefully, and the interest aroused in such ways as to create an atmosphere in which the individual is conscious merely of being a pupil working with an instructor toward a purposeful goal, rather than of being a "patient" or a "case" who is receiving treatment. It will be seen, then, that the differentiation is between class and individual gymnastics, and that "individual gymnastics" is a better term than "corrective gymnastics" for this type of work.

In many schools, colleges and Young Women's Christian Associations the need is being recognized, and departments for individual gymnastics are being established, under the direction of special teachers whose entire time is devoted to such work. The results obtained have been most gratifying. The aim in all cases is to make the work progressive, in order that the pupil may, through improvement of condition, be transferred from individual to class exercises as soon as possible. The pupil is also encouraged to participate in all healthful activities, dancing, games and sports, with strong emphasis on recreational values.

Thus, individual gymnastics has a definite place, and one of much value in the great program of physical education, the goal of which is worthy living and social realization through the development of the psycho-physical potentiality of the individual.

CHAPTER II.

EQUIPMENT. APPLICATION OF INDIVIDUAL GYMNASTICS. GENERAL DIRECTIONS. PLAN OF EXERCISE PROGRAM. TEACHER'S RESPONSIBILITY. PSYCHOLOGY OF INDIVIDUAL GYMNASTICS.

EQUIPMENT.

Apparatus.—The apparatus required is fairly simple. A large number of mechanical appliances is unnecessary. These are used, to some extent, in hospitals and in the gymnasiums of the specialists where extreme conditions are to be met, and by their means more forceful correction can be applied and the strength of the instructor conserved.

The minimum equipment, however, should include one horizontal bar, adjustable to different heights; several heavy mats; stall bars and benches; a narrow plinth, and a few wands and dumb-bells of various weights. Valuable adjuncts for training in muscle control are mirrors, adjusted at angles permitting observation of the figure from the front, back and side. These mirrors are especially useful in the correction of posture. The ideal arrangement is to have a central mirror fixed to the wall, with a hinged mirror of the same size attached to each side, which may be adjusted at all angles; but a less expensive way is to fix two mirrors at right angles in a corner and use a full-length dressing mirror in addition, which can be moved about easily to accomplish the desired result.

A Swedish boom is often useful, also a pair of rings.

The gymnasium plinth illustrated is an excellent piece of apparatus; the special features are its height, narrow body, and the movable foot supports, which make it adaptable to many sorts of exercises. It may be purchased from the Narragansett Machine Company, Providence, R. I., if desired.



FIG. 2.—Gymnasium plinth.

The Gymnasium Suit.—The gymnasium suit should be arranged so that the back of the pupil may be easily exposed at any time during the lesson. It is almost useless to try to obtain results worth while if the teacher is unable in this manner to observe frequently the effect of the exercises. After many experiments, we solved the problems of utility and economy by requiring each pupil to wear bloomers, and a middy blouse cut open the entire length of the back and closed with snap fasteners or buttons. In such a garment, the figure is completely covered or may be laid bare at a moment's notice.

Shoes.—Gymnasium shoes should be worn, or better still, no shoes at all, and the straight position of the feet emphasized, so that the muscles may be used with perfect freedom, and the feet thereby be strengthened. An extra pair of stockings or pair of men's socks, which can be slipped on over the other stockings, makes a desirable substitute for the gymnasium shoe.

THE APPLICATION OF INDIVIDUAL GYMNASTICS.

In the application of exercises, too much stress cannot be laid on the importance of making the lesson individual. Preferably, only one pupil should receive attention at a time. With children there should never be more than two, and in such cases, the exercises ought to be so planned that one child may receive the maximum attention from the teacher when performing the more difficult and carefully localized exercises, while the other is doing simpler work, that requires less supervision. Some children work better if there are two together, as there is the increased incentive of competition. With others this is not at all desirable, as the attention may be distracted and concentration lost. Consequently, no positive rules can be laid down and decision as to the best method with each pupil must be left to the discernment of the teacher.

Under some circumstances when, with limited time, it is necessary to provide for many lessons as in schools and colleges, it has been found possible to organize small groups whose lessons can be satisfactorily supervised by one instructor. The size of the group should be regulated by the judgment of the teacher, with reference to the types of exercises necessary and the seriousness of the conditions needing attention. The field of individual gymnastics is

broadening rapidly, and at the present time so many inquiries are being made by instructors in physical education, who are dealing with large classes as to the possibility of individual work with groups, that ways and means must be found of meeting the need in some way. The discussion of this subject will be taken up more at length in a succeeding chapter.

After a physical examination, a program of exercises is planned by the teacher, which will meet the requirements of the pupil. This program is carried out at each subsequent lesson under personal supervision. Exercises should be definite, executed carefully and slowly, and repeated day after day with little variation. It is not necessary to change the program frequently, as progress does not mean the acquirement of many new movements, but rather proficiency in a few. More benefit may be gained by obtaining perfection of form and ease of execution in a few exercises, than by doing a larger number carelessly, or with strain. However, from the point of view of stimulating interest, it is wise to change exercises from time to time—perhaps only by an altered position of the hands, or an increase in the number of times an exercise is performed.

Length and Frequency of Lessons.—A lesson period varies from thirty to thirty-five or forty minutes, depending upon the general condition, age, strength and endurance of the pupil. With a young child or one showing a condition of weakness, or in the case of an old person with little resistance, for example, the lesson at first may be limited to a fifteen-minute period. Work should be intensive, with definite intervals of relaxation, and modified at the discretion of the teacher. Daily lessons are advisable in every case when possible, especially where there are extreme conditions or persistent deformities. Only by this means can the best

results be reached. If a daily lesson is impossible, three a week should be urged. Two lessons a week should be the minimum, and hardly sufficient when dealing with unusual conditions. It is well to teach one or two simple exercises that may be done at home. Instructions in regard to the general hygiene, and stressing the need of standing and sitting correctly are of prime importance and should never be omitted. Each lesson should be terminated by a five-minute period of relaxation, lying flat on the mat. If the lesson period is of forty or fifty minutes' duration, it is desirable to divide the period by five minutes' relaxation also. Better results are reached by a fifteen or twenty minute period of intensive work, followed by five minutes' relaxation—then another intensive period, with a final relaxation in the lying position.

Objectives.—In the application of exercises to individual needs, it will be noticed that the lines along which it will be most desirable to work in the reestablishment of symmetry and of normal conditions, are fairly definite, and may be stated as follows:

1. Improvement of the general condition.
2. Strengthening muscles.
3. Increase and equalization of flexibility.
4. Readjustment of muscle control.

Types of Exercises.—Exercises are grouped, according to type, into *passive*, *assistive*, *active* and *resistive*.

A *passive* exercise is one wherein the muscles are without active effort on the part of the pupil, exercised solely by the aid of the teacher.

In cases of extreme muscular weakness, such as may follow a debilitating illness, or after infantile paralysis, these passive exercises are of great value. They are also used with good results in stretching contracted tissues, and in limbering up stiff joints where movements have become limited.

The *assistive* exercise is executed actively, according to the ability or strength of the individual, aided by the teacher in order to make the movement of greater range or strength.

The *active* exercise is performed by voluntary muscular action without assistance.

A *resistive* exercise is used in order to make a movement more vigorous. There are two types, both executed against resistance.

In the *concentric resistive* exercise, the muscles contract and shorten, overcoming the resistance.

In the *eccentric resistive*, the muscles, though in strong contraction are at the same time being lengthened by the resistance—that is, the resistance is overcoming the muscular contractions.

By far the larger number of exercises are of the active type. The greater value of these is being recognized more and more, while passive and resistive exercises are usually reserved for special conditions. This is not alone from the point of view of the comparative value of the exercises, but for the conservation of the teacher's time and strength, a highly important consideration. The expenditure of energy by the teacher, with the pupil as a more or less passive agent, has oftentimes been tremendous, and out of all proportion to the results accomplished.

One of the chief values of active exercises is that they develop powers of subjective motor control. The individual becomes conscious of the body mechanism as a working entity, with all its parts related segments. Arm and leg movements, for example, are seen not as simply local movements, but as purposeful activities which will help in the establishment of a finer adjustment of the whole body. The fact that these exercises can be performed without assistance or apparatus, even in a limited space, makes them practical.

PLAN OF EXERCISE PROGRAM.

It is the common experience that in planning programs the number of exercises required is comparatively small, for the same ones can be used with such slight variations as make them adaptable to various conditions. There are some "old reliables" which have proved indispensable and have been used almost from the beginning of corrective work. For them no substitutes have been found. Others, hopefully welcomed as "something new," have been tried and discarded as of little or no intrinsic value.

We have also to guard against stock sets of exercises, for it is a fact that no two pupils are exactly alike. Teachers frequently ask for "a set of exercises" or a list of movements for "round shoulders," "lateral curvature" or some other condition, but a routine list should be given with care, with the understanding that it should be subject to modification, as there is a possibility that harm rather than improvement might result otherwise.

For the convenience of the teacher, exercises should be grouped as nearly as is possible with reference to their special application, then from these groups such exercises can be chosen as will meet the needs of the case in hand.

In planning a program the intelligent understanding of the individual condition is most important. The uninitiated teacher seeing, for example, a child with stiff, round shoulders might think she was doing her duty conscientiously by giving six or eight exercises directed entirely to the local condition of the shoulders, not appreciating the fact that it is the readjustment of the whole body that is necessary. The program should include exercises for improving the general condition, for the weak abdominal muscles, to increase the lung capacity, to improve coördination, but,

above all, the proper mental attitude toward correction must be established.



FIG. 3.—Showing the possibilities of supervised individual work with a group in a gymnasium with simple equipment. (Individual Gymnastics, Central School of Hygiene and Physical Education, New York City.)

The program is also constructed much after the manner of a "day's order." It should be so arranged as to progress from simple exercises at the beginning up to the more difficult ones and then slow down toward the end. If the pupil is delicate, or if there is any heart weakness present, the pulse should be taken at the beginning and end of the lesson to determine whether it has been too severe. A record of the weight is also helpful, as any marked decrease might be an indication that the general condition was falling below par and should be investigated.

THE TEACHER'S RESPONSIBILITY.

The question as to the amount of responsibility which a teacher may assume, is an important one. Care should be taken not to go beyond the prerogatives of the profession. With a child, in case an abnormal condition has been observed, the attention of the school physician ought to be drawn to it. The parent should be notified, with the suggestion that the family physician be consulted. Thus the initial responsibility is placed with the parent. It is understood that the teacher is ready to coöperate by giving advice if called upon, and in planning and carrying out exercises. With adults, it is also wise to urge medical advice. If there is any doubt in the mind of the teacher, or a condition exhibits persistent pain, a physician's diagnosis should be insisted upon, and no exercises given except by authority.

THE PSYCHOLOGY OF INDIVIDUAL GYMNASTICS.

The teaching of individual gymnastics is not alone the ability to apply certain routine exercises to fit such and such a condition. In fact, this is the least part of the work. In

addition thereto the teacher needs to be a practical psychologist. A child may be "put through" a list of exercises for half or three-quarters of an hour, and the benefit be *nil*, as compared with the result to be obtained from a fifteen-minute period where such a relation between the teacher and pupil has been established through arousal of interest, that the latter recognizes the fact that it is a coöperative plan, with both teacher and pupil working toward a purposeful goal.

Dr. Dewey makes a statement to the effect that "Drill is valueless when it becomes a meaningless, unthinking process of repetition."¹ This thought is peculiarly applicable to individual exercises. If the work is executed in a routine way, motivated only by a sense of unavoidable duty, with eyes on the clock and the thoughts elsewhere, the time is wasted. There may be an external form manifested temporarily, but the internal stimulation is what really brings results. Exercises that lead to intensive habit-forming, require active thought in the doing. There must be an appreciation of the need for the work, a reason for the repetition of the exercises over a long period of time, and a desire to accomplish results.

The teacher's task is no light one. There must be infinite tact and patience with unbounded enthusiasm on the part of the instructor. The wise teacher will set up objectives, catching the interest through "purposeful activity." The individual will see herself not as she is but as she desires to become. The stimulation of interest is all-important. There will be necessarily a different appeal, according to age and temperament. One of the most difficult problems is with the child who comes for exercises because he is being

¹ Dewey: "How We Think."

sent. Yet no child is without some pride and interest. The tactful teacher must find the vulnerable point and so establish a foundation on which to build. In many instances it is helpful to explain the reason for doing the exercise—even elementary instruction in anatomy may be made interesting—thereby dispelling the feeling that the teacher is imposing an arbitrary and oftentimes distasteful program. The promise of promotion to class work as soon as sufficient improvement is shown, has a salutary effect. Many people are highly sensitive, and embarrassment and self-consciousness may often be mistaken for indifference. There is a certain type with whom there must be constant appeal to the pride, while another type merely needs encouragement, and at the risk of reiteration we urge a careful consideration of individual differences. A teacher who is not interested in the study of human nature, or who has not tact and adaptability, will fail in the field of individual gymnastics, even though her technical knowledge be complete.

CHAPTER III.

ANATOMY OF THE HUMAN BODY. PLANES OF THE BODY. PHYSIOLOGICAL CURVES. INCLINATION OF THE PELVIS. MOVEMENTS OF THE SPINE.

ANATOMY OF THE HUMAN BODY.

THE human body is a segmented mechanism. Its framework of bones, the skeleton, held together by ligaments and moved by muscles through stimulation by the nervous system, is capable of constant and intricate adjustments for the purposes of weight-bearing and the maintenance of equilibrium.

In order to have a clear understanding of the maladjustments which are present in conditions of faulty posture, scoliosis, and so forth, it is essential to have in mind the normal anatomy, especially as to the interrelation of these movable segments.

The Vertebral Column, Spinal Column, or Spine, is composed of a series of vertebræ superimposed on one another, with a disk of fibrocartilage between each two with the exception of the first two cervical vertebræ, the atlas and axis. These intervertebral disks which are firmly attached to the bodies of the vertebræ give elasticity and mobility to the spine and serve to lessen the jar incident to bodily activity.

The Vertebræ.—There are thirty-three of these bony masses. The upper twenty-four are known as the movable

or presacral vertebræ. Of these, there are seven cervical, twelve dorsal or thoracic, and five lumbar. The lower nine are fused together to form the sacrum and coccyx, and are called the fixed or immovable vertebræ.

Each vertebra, roughly speaking, consists of an irregular ring of bone surrounding an opening known as the vertebral foramen. When the vertebræ are superimposed to form the column, these foramina constitute the vertebral canal which encloses and protects the spinal cord.

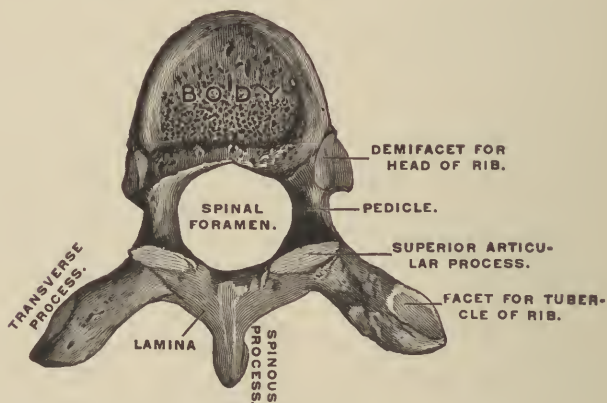


FIG. 4.—A thoracic vertebra seen from above. (Gerrish.)

The features common to all vertebræ, with the exception of the atlas and axis, are the body; two transverse processes; four articular processes; one spinous process; two pedicles and two laminae (Fig. 4).

On the thoracic vertebræ are facets showing the points of attachment of the ribs. The presence of these facets and the downward obliquity of the spinous processes are the distinguishing characteristics of the thoracic vertebræ.

The lumbar vertebræ are much heavier and the spinous

processes more nearly horizontal, while the cervical vertebræ are lighter, have foramina in the transverse processes and the spinous processes are bifid.

The Ribs.—There are twelve pairs of ribs which articulate posteriorly on the bodies and transverse processes of all the thoracic vertebræ. The upper seven pairs are attached anteriorly by means of cartilage to the sternum; the next three to the cartilages of the ribs above, while the last two are free, and are called the “floating ribs.”

Thorax.—The body cavity formed by the articulation of the spine, ribs and sternum is called the thorax. It is strengthened and protected above by the shoulder girdle, which is formed by the scapulæ and clavicles.

Scapulæ.—The scapulæ, or “shoulder-blades,” are triangular in shape and lie one on either side of the spine, their vertebral borders equidistant about one inch, and are superimposed over the posterior aspect of the ribs from the second to the seventh or eighth.

Clavicles.—The two clavicles, or “collar bones,” are slender, flexible and curved, and articulate at one end with the sternum, and at the other with the acromion process of the scapula.

The Occiput, or Head, is balanced upon the first cervical vertebra or atlas, and obtains great freedom of motion through the movement of the atlas upon the axis.

The Humerus, Ulna, Radius and Bones of the Hand complete the jointed mechanism of the upper extremity, their points of articulation forming the shoulder, elbow, wrist and finger-joints.

The Pelvis.—The pelvis forms the base of support for the spine; is analogous to the shoulder girdle and is sometimes called the pelvic girdle. It is formed by two bones, the ossa innominata, meeting anteriorly at the symphysis pubis, and

articulating posteriorly with the sacrum at the sacro-iliac joints. The pelvis is supported in its turn upon the bones of the lower extremity; the femur, tibia, fibula and bones of the feet.

Ligaments.—The bones of the skeleton are firmly bound together by the ligaments, strong bands of inelastic fibrous tissue, forming a strong capsule around each joint. The ligaments of the vertebral column are numerous. They are so arranged as to give great strength and to limit the movements of the spine. The anterior and posterior common ligaments connect the bodies of the vertebræ all the way from the atlas to the sacrum. The ligamenta subflava connect the laminae; the capsular surround the articular processes; the spinous processes are connected by the supraspinous and the interspinous ligaments, which are continued from the seventh cervical vertebra to the base of the skull, by the strong ligament of the neck, the “ligamentum nuchæ”; while the transverse processes are connected by the intertransverse ligaments.

The Y-ligament or Iliofemoral Band.—This is one of the most essential ligaments in the body and is of great importance in its support in the upright position. It is part of the capsule of the hip-joint, extending diagonally across the hip-joint anteriorly from the ilium to the head of the femur in the form of an inverted Y.

Muscles.—It is necessary to have in mind, not only the location and action of the individual muscles, but also to have an understanding of the working of muscles by groups, and their action in bodily movements as motor, fixator, antagonistic or steadying agents.¹

On the front and back of the body, groups of muscles

¹ Refer to Bowen's Applied Anatomy and Kinesiology.

called antagonistic are situated, the proper tone of which has direct bearing upon the maintenance of the erect posture,

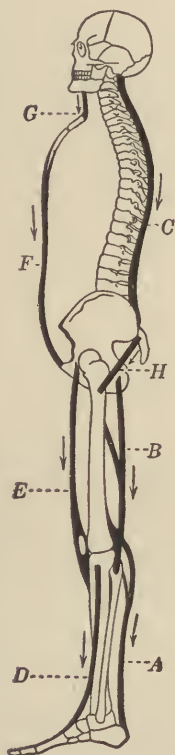


FIG. 5.—Diagram showing the action of antagonistic muscles which keep the body erect. (After Huxley.) Arrows indicate the direction of the pull, the feet serving as a fixed basis of support. The muscles *A*, *B*, *H* and *C* keep the body from falling forward; *D*, *E*, *F* and *G* keep it from falling backward. (Hough and Sedgwick.)

by keeping the segments of the body in correct relation to one another.

1. Groups connecting the head to the trunk.
 2. Groups connecting the trunk and pelvis.
 3. Groups connecting the pelvis and lower extremity.
- (Fig. 5.)

PLANES OF THE BODY.

Anteroposterior or sagittal plane passes through the body from head to feet in the axis from front to back. When observation of the body is made in this plane it is seen in profile. Frontal or coronal plane passes through the body from head to feet at right angles to the antero-posterior plane. Transverse plane cuts the body horizontally.

PHYSIOLOGICAL CURVES OF THE SPINE.

The normal or physiological curves of the spine (Fig. 6) are formed early in life as soon as the upright position is assumed. They give ease and elasticity to the body in its activities. These curves are in the anteroposterior plane, concave forward in the cervical region, convex backward in the thoracic region and concave forward in the lumbar region. In the position of rest, these curves are kept in proper place by the balance of antagonistic muscles. It is their exaggeration that is the outstanding feature in faulty posture. In the young infant these curves are not present — the spine making one long curve backward in its entire length.

INCLINATION OF THE PELVIS.

In all departures from the normal symmetry of the body, especially in faulty anteroposterior postures, the position of the pelvis in relation to the horizontal plane should be considered, since it is especially liable to change. Either

the inclination will be increased, that is, the pubic arch will be tipped downward too far, or the inclination will be

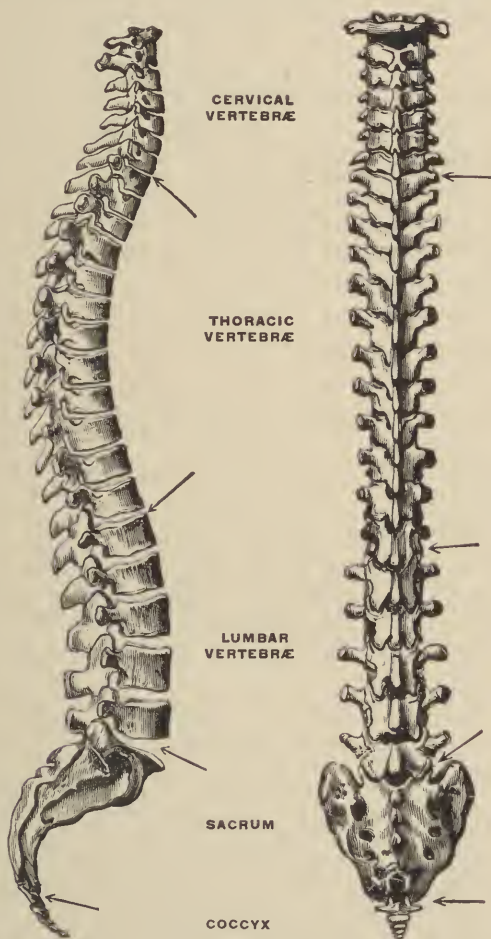


FIG. 6.—Showing physiological curves and regions of the spine. (Gerrish.)

decreased, and the pubic arch in this case will be tilted upward. Increased inclination accompanies exaggeration of

the lumbar curve (lordosis), and decreased inclination is found when the lumbar curve is too flat or when the person stands with the body weight over the heels.

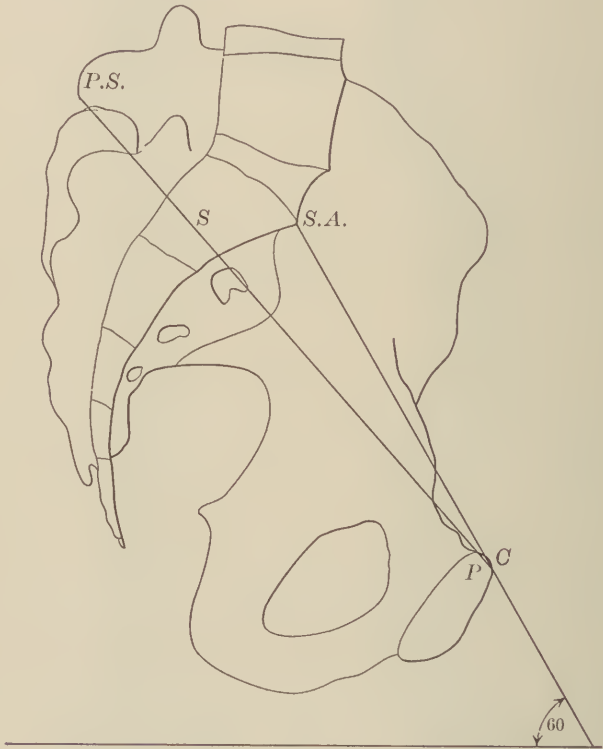


FIG. 7.—Inclination of the pelvis. Median section through the pelvis: *P*, pubes; *C*, pubic crest; *S*, sacrum; *S.A.*, sacral angle; *P.S.*, posterior spine. (Spalteholz.)

The normal inclination of the pelvis is determined by a line drawn from the sacrolumbar junction through the symphysis pubis and projected downward to meet a horizontal line with which it makes a certain angle. Many obser-

vations have been made and the generally accepted conclusion is that the inclination in the normal woman is slightly greater than in man, but that both come within a range of from 50 to 60 degrees (Fig. 7).

When we consider that the pelvis is the base of support for the spine and therefore of the trunk as well, it is evident that the angle of inclination has a most important bearing upon the posture of the trunk, as any alteration in the position of the pelvis will cause an adjustment of the superimposed structure. Its position, therefore, becomes one of the initial considerations in the establishment of a correct posture—a fact often overlooked.

MOVEMENTS OF THE SPINE.

Because of the anatomical structure of the spine and thorax, there is less freedom of motion than appears to the casual observer. The apparent flexibility of the spine is due to the freedom possible in the upper cervical region by movements of the head and by action of the whole spine on the pelvis. Movement in the hip-joint is often mistaken by the casual observer for movement of the spine. The importance of bearing this in mind will be seen in the application of exercises, where proper localization is essential.

Deductions have been drawn as to the relative degree of movements possible in the different regions of the spine, as follows:¹

Flexion.—1. Considerable in cervical region between head and spine; slight in the rest of the cervical region.

2. Thoracic region. Slight.

3. Lumbar region. Very free.

¹ Lovett: Lateral Curvature of the Spine and Round Shoulders.

Hyperextension.—1. Cervical. Slight.

2. Thoracic. Slight.

3. Lumbar. Very free.

Lateral Bending and Rotation.—1. Cervical. Free lateral bending with slight rotation.

2. Thoracic. Less free lateral bending with considerable rotation.

3. Lumbar. Very free lateral bending with little rotation.

CHAPTER IV.

THE UPRIGHT POSTURE. VALUES OF POSTURE.

THE UPRIGHT POSTURE.

BEFORE entering upon a study or description of the faulty attitudes or postures which are astonishingly prevalent, it is well to make some rather careful deductions from present knowledge of the much-discussed erect posture. What is the ideal posture of the human body, and what is the significance of the emphasis which is placed upon it? It has been said that man was intended originally to walk on "all-fours," but that through the developmental phases of evolution he has acquired the unique habit of standing erect. For this distinction, however, he often pays the price of various consequent ills, such as flat-feet, varicose veins, hernias, scolioses and faulty postures. It is obvious that to preserve the equilibrium while walking upright requires an accurate adjustment depending upon a fine neuromuscular control. The problem is that of keeping the body at all times in such relation to the center of gravity that this upright position may be maintained with a minimum amount of effort. These adjustments would be unnecessary if the body were supported in the horizontal position, upon four feet instead of upon two. One writer has most aptly said that the human mechanism is "a quadruped skeleton, set up on end."

Center of Gravity.—The center of gravity of the body varies slightly with individuals. Through observations and experiments by Drs. Lovett and Reynolds, the following conclusions have been reached:

“In the erect position the center of gravity of the body lies in front of the ankle-joints, which are held from dorsal flexion in this position by the gastrocnemius muscles. The center of gravity lies also in front of the knees, which are similarly held in position by the hamstring and quadriceps extensor muscles. The center of gravity lies also anterior to the sacro-iliac joints and most of the vertebral joints.

“In the erect position the trunk is held extended on the legs by the combined and continued action of the posterior musculature, the chief factors here being the hamstrings, the glutei and the erector spinæ muscles.”¹

The arrangement of muscles on the front and back of the body and their action in keeping the body erect, has been likened to the arrangement of guy ropes on a flagstaff, which by their equal pull on all sides enable the staff to maintain its perpendicular position.

As the body weight is supported on the lower extremities, then if the axes of the body segments, the head, trunk and legs are in such relation to one another that they approximate a straight line, it can be easily seen that such weight would be supported in the most economic way and balance would be preserved with the least resistance to the center of gravity. If, on the other hand, these segments form a series of angles with one another, thus falling out of alignment with the center of gravity, balance is disturbed, the muscles no longer pull equally, the resistance to gravity is increased and the body is in a less advantageous position for its activities (Fig. 8).

There are certain undeniable advantages in the upright posture of great value to man in his activities, aside from the esthetic aspect. The opportunity for free use of the hands

¹ Lovett: *Lateral Curvature of the Spine and Round Shoulders.*

and arms would not be possible in the horizontal position, and the number and range of movements would be fewer and more restricted. It is noticeable that among the mentally

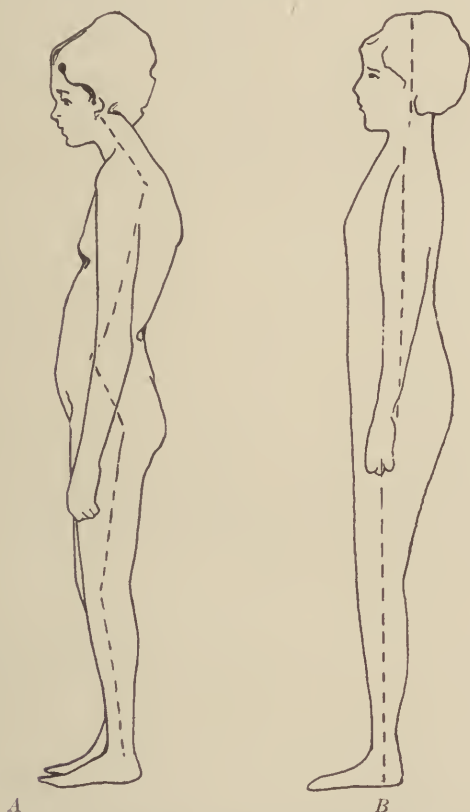


FIG. 8.—*A*, axes of body segments, a series of diagonal lines; *B*, axes of body segments, a series of straight lines.

defective, relaxation from the upright position is a marked characteristic, and as mental control becomes less, there is a tendency to return to the horizontal position.

ANALYSIS OF CORRECT POSTURE.

For the term "good posture" no absolutely definite standard can be given. It is the proper relationship between the parts of the body which corresponds to an ideal in the mind of each individual by which he almost instinctively recognizes "good posture" as distinct from "poor posture" although oftentimes he does not live up to this ideal. Good posture indicates mental and physical poise. The body should be well balanced, in a position of ease, with the weight borne equally on both feet, the knees and hips extended, but not hyperextended; the body should be held as tall as possible, without strain; the head erect and easily poised, with no tension in the neck; chest elevated; abdomen retracted; arms hanging easily from the shoulders.

In teaching this posture, it is a mistake to call attention to too many of the body segments. Simple directions are best. An awkward and stiff posture is liable to result from such instructions as these: "Head up: Shoulders back: Chest high: Abdomen in: Hips back:" etc. A much better result is attained by giving a simple explanation of the meaning of good posture in the beginning, followed by the direction, "Stand as tall as possible," or "Pull up with the head—keep the chin horizontal." This usually brings a good response. Ease and freedom from tension should be emphasized.

The inclination of the pelvis is of great importance, as it controls the position of the spine. Considerable attention should be given to training the pupil to learn the muscular coördinations which shall enable him to control the position of the pelvis. The most common fault is that of throwing the hips too far back, and thus exaggerating the lumbar curve. The muscles of the lower back and waist usually

need to be strengthened in order that they may hold the trunk in such stable position that the superincumbent structures of necessity become properly adjusted, the chest elevated, the head well poised, and the arms easily pendent at the sides of the body.

In this position the body is in its most advantageous adjustment for work and the individual is ready for instant response to any stimulus with the least output of effort. Conservation of time and energy are the keynote of this, as of every endeavor. As the great demand of the world is for efficient service, each individual should meet the need, as a matter of individual responsibility, by making himself, as far as possible, a well-developed and adjusted whole, in order that he may best perform the work that he undertakes.

VALUES OF GOOD POSTURE.

The values of good posture may be grouped as hygienic, economic, social and esthetic. If we appreciate these values fully we must see that good posture becomes an asset of importance.

Hygienic.—It is of comparatively recent date that the bearing of posture upon health has been realized. Formerly, the chief arguments for good posture were from the esthetic viewpoint. But to stand erect, to walk easily, to have a well-adjusted body are far more important from the standpoint of health. This has been made the subject of extensive observation and study by some of the eminent physicians and surgeons of the present day, Dr. Goldthwait lays great stress upon its significance in the diagnosis of ailments seemingly of obscure origin, and traces a long and pernicious train of ills to faults of bodily posture.¹

¹ Goldthwait: Relation of Posture to Human Efficiency.

In the well-poised body all the organs are held in the best position for the proper performance of their functions. The chest is expanded, giving room for the lungs and heart, and thus the great processes of respiration and circulation can be carried on normally; there is no cramping of the stomach and liver, while the retraction of the abdominal walls supports the enclosed viscera in their elevated and natural relations. Consider the reverse of this picture—the relaxed posture, drooping shoulders, depressed chest, protruding abdomen—with the resulting maladjustment of the organs. The lungs will be cramped, there will be less room for the heart, the stomach and liver will receive undue pressure and there will be sagging of the abdominal and pelvic viscera. The functions of the organs are then interfered with, and the result may be seen in disturbances of the respiration, circulation, digestion and of the nerves, while many menstrual difficulties are correctly traced to “ptosis,” resulting in displacement of the pelvic organs. Such conditions indicate, at least, a lowering of the vital index and put the individual physically below par. The best work cannot be accomplished without a background of health, so a good posture, meaning better health, implies increased power.

Economic.—The posture and bearing, which express dignity and poise, suggest latent power which impresses a would-be employer with confidence in one’s ability. In a report, not long ago, noting the qualifications of a good teacher, was the following statement relative to the importance of posture, “The applicant, otherwise well qualified, walked herself out of a 1500 dollar position in eight steps.” From this viewpoint the importance of an erect bearing cannot be overestimated in the purely business consideration of the ability to secure and hold a position.

Wherever she or he may be, classroom, business office, drawing room or place of emergency, the woman or man of erect posture will be first, in the nature of things, to receive attention and to command respect.

Social.—A good posture reacts upon the individual in an increase of self-respect, and gives one confidence of his ability to present a good appearance before his neighbors, and a power to look the world in the eye. These values are undoubtedly greater than is realized.

The relation between the physical, mental and spiritual natures is so close that one cannot be ministered to alone. Posture is expressive of mental states, so relaxation of posture implies mental relaxation as well. People are frequently unaware that they are expressing themselves in this way. Emerson says "What you are, speaks so loudly that I cannot hear what you say." It is a psychological fact that "The assumption of an attitude expressive of a certain emotion tends to produce that emotion." Depression is expressed by a lowered head, a flattened chest, and robs the gait of buoyancy, but a fit of the "blues" cannot withstand deep breathing and an erect carriage. Prof. James says, "Whistling to keep up your courage is no mere figure of speech; sit in a moping posture and your melancholy will linger." It is almost instinctive to stand erect to overcome fear, and the first step in resisting defeat is to lift the chin. One of the greatest assets of the actor is the ability to convey impressions of emotions and characteristics to an audience by means of posture. A strong, erect posture expresses to the world at large, strength of will, alertness, poise, and the joy of living. All of which makes the individual a more useful social unit and a greater asset to the community.

Esthetic.—From the point of view of appearance, good posture is important. An erect bearing is more pleasing to the eye than a “slouch,” and clothes show more graceful lines and appear at greater advantage when worn on a



FIG. 9.—The young Franklin, by Dr. R. Tait McKenzie, University of Pennsylvania, Philadelphia, Pa.

figure held with dignity. A youthful appearance can be preserved longer by holding a good posture than by using cosmetics, or by following the innumerable devices for prolonging youth.

Sculpture and painting offer interesting material for study of posture, both correct and incorrect, and the eye becomes trained to recognize lines of symmetry. Observation of those passing on the street impresses one with the fact that few people walk and carry themselves well. The slouchy gait and awkward carriage are common. An alert, well-set-up individual is noticed at once, and an involuntary tribute is paid to the values of posture when we say, with approbation, "How well that person carries himself."

Posture should be dynamic, not static, and should proclaim not alone the ability to assume an erect bearing in the gymnasium, under the eye of the instructor, but a well-coördinated mechanism, prepared at all times to meet any physical requirement in the best manner and with the greatest ease. It is not to be put off and on like a garment, but should be fundamental, functioning in all the activities of life. The aim is to acquire habits of good posture, rather than a habit.

The lad who has established these powers of bodily control will naturally assume better postures in his sports, and will consequently play a better game of baseball than his companion, who manages his body carelessly and less economically. The college girl will excel at tennis or as a member of the crew if she has learned that "posture" denotes the proper management of her bodily mechanism in all activities.

Not only at the present time but through the history of past ages the subject of posture has been one of great moment. All people, however low in the scale of culture, recognize the power behind a confident, upright bearing as against a cringing apologetic attitude. The Greeks placed so great value on the ability of man to carry himself erect that they called it a special gift of the gods, the legend

running that Prometheus created man to walk on two feet instead of four, and to gaze upon the stars, the abode of the gods.

Posture is an index of personality. A poised and upright bearing usually connotes strong mentality, health, self-command and leadership. There are exceptions to all broad rules, so it is possible to find a noble physique housing vicious tendencies; but this is rare, as the lower instincts are usually proclaimed otherwise. Almost, if not absolutely never, does a feeble-minded person stand upright; an unhealthy person is seldom erect, and the timid, self-conscious individual is not commanding in bearing.

Conversely it may be claimed that a man or woman who consciously and determinedly walks erect, gains in self-respect, improves in health and receives an impetus to clearer thinking and to ennobled living. It must then be conceded that posture is of deep psychological import.

CHAPTER V.

ANTERO-POSTERIOR FAULTY POSTURES.

DIFFERENTIATION OF DISEASED CONDITIONS.

It should be borne in mind from the outset that antero-posterior faulty postures are *not* conditions of disease of the spine, nor do they lead to it. They are the result of asymmetrical growth and faulty adjustment.

There is a disease of the spine, however, known as Pott's disease, or caries of the spine. This is a tuberculous condition, which in its early stages might be mistaken for faulty posture. This disease is accompanied by pain, which should indicate to the teacher that exercise should not be given, but that the advice of a physician, preferably that of the orthopaedic surgeon, should be sought.

It is well to remember that persistent pain is always a danger signal and its cause requires investigation. Great harm might be done if the teacher were not intelligent in this matter, for while exercise is the rational treatment for the correction of faults of posture, it is absolutely forbidden for diseased conditions.

TYPES OF FAULTY POSTURES.

The faulty postures occurring in the anteroposterior plane of the body comprise those defects commonly designated as "round shoulders." This term, however, is a narrow one if interpreted to mean only the incorrect position of

the shoulders, for this is but one feature of the condition. Its correction involves the consideration of all the body segments, from feet to head, and of their interrelation and adjustment to the center of gravity. Therefore, the name "anteroposterior faulty postures" is much more inclusive.

Types within this designation vary; in fact, they differ almost as much as the individuals who exhibit them. For convenience of study, and for ease in planning exercise for their correction, they will be classified as nearly as possible into certain rather definite groups.

The terms *kyphosis* and *lordosis* are in frequent use in reference to faulty posture, and may be defined as follows:

Kyphosis. Increase of the normal physiological curve in the thoracic region.

Lordosis. Increase of the normal physiological curve in the lumbar region.

Stoop Shoulders.—This is a condition in which the main difficulty is the forward projection of the head, sometimes involving the upper thoracic as well as the cervical region. The seventh cervical vertebra is usually prominent. Stoop-shoulders, as a state, is accompanied by a flat chest, with hollows under the clavicles, but there is little or no change in the mid-dorsal and lumbar regions of the spine.

Round Back.—In this type the entire back is relaxed; the rounding of the thoracic curve seems to encroach upon the lumbar region, almost obliterating the curve in that area. The weight of the body is also carried over the heels, the whole trunk settling back at the sacrolumbar junction. This type is sometimes called "sway-back." This would be a condition of marked kyphosis (Fig. 10).

Hollow Back (Lordosis).—The posture of the head and shoulders may not be affected, but the lumbar curve is exaggerated and the inclination of the pelvis will be increased. Also the knees are usually hyperextended.

Round Hollow Back (Kypholordosis).— Perhaps this is the most common type of all, in which both kyphosis and lordosis are present. One curve seems to complement the



FIG. 10.—Typical “kyphosis,” “round back,” or “sway-back.”



FIG. 11.—Typical “round-hollow back.”

other in an effort to reëstablish the balance lost by the initial faulty position (Fig. 11).

Flat Back.—In this type there is a lessening of all the physiological curves, especially the lumbar. It is a very

weak type of back, and is accompanied by forward drooping of the shoulders and flattening of the chest. It is frequent in older women, and is apt to be attended by backache, because of the undue strain upon the muscles of the lower back, produced by the faulty bodily mechanics.

With all these types there will be found maladjustments of the shoulders, chest, scapulæ and abdomen.

Shoulders and Chest.—The forward position of the shoulders is a noticeable feature in all antero-posterior types of faulty posture—the inward rotation of the humerus with the accompanying contraction of the pectoralis major and minor muscles, making one of the difficult problems of correction.

With the forward position of the shoulders will be found such conditions as the flat contracted chest, the hollow chest, depressions under the clavicles, recession of the sternum, and other maladjustments.

Scapulæ.—These may be prominent with the vertebral borders raised and drawn forward (the so-called “winged scapulæ”). This condition shows the relaxation of the rhomboid and trapezius muscles with a resulting contraction of the pectoralis major and anterior portion of the deltoid. It sometimes happens in cases of this character, that the whole shoulder girdle is pulled downward and forward, resulting in the prominence of the inferior angles of the scapulæ. When this takes place, the pectoralis minor, by its attachment to the coracoid process of the scapula, exerts too great a pull, especially when the posterior scapular muscles are relaxed. Undoubtedly, the forward pull of the serratus magnus is also a factor in the faulty position of the scapulæ.

Abdomen.—Muscular relaxation of the abdominal walls is frequently associated with this deformity of the back and a prominent abdomen is also a characteristic accompaniment.

Inclination of the Pelvis.—This may be either increased or diminished. The correction of either defect should be regarded as fundamental in the treatment.

The Feet and Knees.—The feet and knees are to be considered also, as the position of the pelvis is materially affected by their placement. Pronated or weak feet and hyperextended or flexed knees are often present.

A series of conditions seemingly interrelated are as follows:

1. Hyperextended knees causing increased inclination of the pelvis; this leading to lordosis.
2. Flexed knees, causing decreased inclination of the pelvis, leading to obliteration of lumbar curve, and encouraging "round back."

FLEXIBILITY OF THE MECHANISM.

All types of faulty posture come under two groups in regard to general characteristics:

1. The flexible, or non-resistant.
2. The stiff, or resistant.

In the flexible type it is possible for the individual, of his own effort, to assume a correct posture, although he may not know how to do it, because muscular coördinations have been lost by the repeated assumption of the faulty position. A child will frequently say that he "feels crooked" when placed in a straight position by the teacher, as the faulty attitude has become habitual and feels "natural."

The treatment of the flexible type, therefore, resolves itself into a reëducation of the muscle sense, and the strengthening of the muscles to make it possible to hold the correct posture.

In the stiff or resistant type, incorrect positions have prevailed for so long that adaptive changes, sometimes very

marked, have taken place in the tissues. In spite of the effort to correct the posture, the individual is frequently physically unable to do so, and in pronounced conditions of extreme stiffness, even the teacher may be unable forcibly to bring the body into correct position.

Under these extreme conditions the problem of correction is much more difficult and complex. The contracted tissues must not only be stretched until a flexibility nearer normal is obtained, but the muscles must be trained until new coordinations are established.

Individuals, by nature, vary as to type; some are stiff, "stocky," or in many instances are muscle-bound. They do not, or cannot, fully and easily extend their joints. Others are loose-jointed or "floppy." Their joints are not only well extended, but hyperextended, and they have almost too great flexibility. With the ability to assume good posture, they can just as readily lose it again, because of their extreme flexibility. The strong, determined mind and the floppy, irresponsible mind are usually concomitants and factors in the difficult problem of correction.

ETIOLOGY.

In investigating the causes of faulty antero-posterior postures, we find that they must be regarded as cumulative in character, and that the situation is one of considerable complexity, for it involves the consideration of conditions in the environment of the individual: the hygiene, surroundings of daily life, habits of work and play, any or all of which may have a direct bearing upon the formation of incorrect habits of sitting or standing, that lead to more or less permanent postural errors.

It seems as if it ought not to be necessary to place such

great stress upon the maintenance of good posture. It should come naturally to the majority of individuals to hold the body easily erect, but it is a very evident fact that this is not the case. Primitive man and savages, living a free, out-of-door life, unhampered by clothing and other restrictions of civilization, have no trouble about posture. It comes naturally, as the by-product of healthy living and proper bodily activity. But "man has become a standing-around, and a sitting-down animal, rather than a running-around one," and is subject to an artificial environment to which the body adapts itself automatically, and the evil influences of which must be counteracted by artificial means. Nearly all the activities of daily life encourage the forward position of the arms and head; sedentary occupations permit the relaxation of the anterior musculature of the trunk, and the tendency of gravity is ever to pull forward and downward.

Muscular Weakness.—Muscular weakness is an important factor in the causation of these conditions. The period of rapid growth and development of the child is particularly critical, for, many times the bony structures grow faster than the muscles, which, therefore, are without sufficient strength to support the skeleton in a normal position. Sometimes this lack of muscular tone is occasioned by improper nourishment, the food being insufficient in nutrient qualities, or the power of assimilation may be poor. In either case both soft bones and flabby tissues may result.

The above mentioned conditions are found in all classes of society, and are not confined to the children of the poor. It is too often the case that the young are pampered as to their appetites, and are allowed to eat all sorts of food, irrespective of its nutritional value. The digestive apparatus suffers thereby, and the result is a depleted condition. Weak

muscle tone also follows illness, with a consequent tendency to the formation of poor habits of posture. The presence of adenoids, causing improper breathing has a distinct bearing upon health, and this, as well as any abnormality or condition affecting the general hygiene of the individual, lowers the strength and may indirectly lead to postural errors or permanent deformity.

Many children, especially those of the cities, obtain far too little exercise. They have no opportunity for that free play that makes for a strong physique. Crowded streets and close quarters do not permit proper sports and there are other demands on their time. Great numbers of children are riding about in automobiles, sitting with inert muscles, when they might be getting healthful activity by running and walking, at least when going to and from school. After a day seated at the school desk, a child frequently exercises only by walking from the classroom to the waiting automobile, to be conveyed home for further indoor study. Even the beneficial exercise of stair-climbing is eliminated by elevators.

Habitual Assumption of Faulty Positions.—This has an important bearing as a causative element. Certain occupations or industrial pursuits necessitate prolonged sitting or standing in one position, day after day, as is the case in shops and factories where employees work at machines, or where girls are sewing, or are at the switchboards of telephones, etc. Typesetters are noted as having difficulty in preserving anything like a good posture, and are often found to be greatly below par physically. From investigations made by an efficiency expert it was found that poor ventilation had a marked effect upon posture.

Much is being done by many industrial companies to improve conditions and they are now paying more attention

to the importance of hygiene and good posture, and in many instances have organized classes in physical education and corrective gymnastics for their employees. From the point of view of the employer this is economy, as it results in increased efficiency and production.

THE SCHOOL PROBLEM.

Of all the occupations of the growing child, that of school is most universal in its bearing and of the greatest importance. So much of their time is spent by girls and boys in the school room, it would seem that the conditions there should be made ideal. On the contrary, many times the situation is quite the reverse.

Not a few faulty postures are undoubtedly caused and fostered by improper seating, careless positions at the desks, and too prolonged periods of study. No amount of corrective work will be of lasting value unless such predisposing causes can be removed. Nearly all the tasks and lessons of the school child encourage the forward position of the head and arms, which in turn tends to draw the head and shoulders forward. The sedentary character of the work permitting the relaxation of the anterior musculature (notably the abdominal and waist muscles) also adds its influence. One writer observes that, "From the third year up most school children sit at least 80 per cent of the school day, or more than four hours out of five."¹ Even if a child were sitting in a good position in a well-fitted chair—a condition that constitutes the exception rather than the rule—the effect would be pernicious enough because of the weakening of the muscles from inactivity.

¹ Bancroft: *The Posture of School Children*.

Again, the fatigue and consequent mental weariness, engendered by school requirements, anxiety over lessons, the concentration necessary for the performance of difficult tasks, produces actual changes in the metabolism of the body, lowers the vitality and likewise its resistance. In addition this is frequently augmented by improperly ven-



FIG. 12.—Good position at school desk for reading.

tilated school rooms. A “vicious circle” is soon formed—poor posture—lowered vitality, and this in turn reacting still further on the posture.

Fatigue Postures.—The resultant poor postures have been recognized so generally that the name “fatigue postures” has been applied to them. Such conditions are found among pupils of all grades, and even among college students similar

situations are present. Because of the necessity for concentration upon the required lesson and of taking notes rapidly, the mind cannot be diverted to the effort necessary for sitting erect while performing tasks that often tax endurance to the utmost.



FIG. 13.—Poor position at school desk for reading.

Many teachers, whose attention has been called to these matters, are now devoting their efforts to improvement along the lines indicated. The best results cannot be expected unless based upon the coöperation of all who are responsible for the present hazards of school life. It would seem that there should be some readjustment of our educational systems whereby these problems could be minimized, if not solved, for education of the individual must embody the "*Mens sana in corpore sano.*"

· If the positions assumed in the school room were of constantly varying character, it is doubtful if harm would result, for the restlessness of young children, the propensity which they show for frequent change of position, seems to protect them from habits of faulty posture. But the ten-



FIG. 14.—Good position at school desk for writing.

dency of the individual is to repeat the same thing over and over, and to adjust one's self to the most advantageous and comfortable position, which is thereafter frequently or constantly assumed until it becomes a routine or fixed habit. The marked increase in faulty posture, as soon as a child begins to go to school, leads to the conclusion that the school

is responsible in a large degree, since it hampers the normal activity of the body.

Adjustment of School Seats and Desks.—It is important to have seats and desks adjusted carefully to each individual, and to have this attended to not only at the beginning of the year, but during the term as well, thus allowing for the



FIG. 15.—Poor position at school desk for writing.

possibility of growth, and also for the probability that some part of the mechanism of the furniture may have slipped out of place. Although the adjustment should be simple, in many schools this is carelessly left to the janitor, who is often in a hurry, and does not appreciate the importance of his task. Perhaps the decision as to the height and size

of the desk and seat is left to the child, or it may be arbitrarily adjusted without reference to the stature of the pupil. Furthermore, some furniture is difficult of adjustment, and so, while a school may be equipped with adjustable furniture, it does not follow that it is properly adjusted.

The faulty adjustments between the desk and seat are of two sorts, viz.:

1. The desk too high.
2. The desk too low.

With the desk too high the shoulders are elevated and the head and chest thrown into an awkward position.

With the desk too low there is not sufficient room for the legs, and the tendency is to slide down into the seat so that the legs may be extended forward, then to allow the trunk to collapse forward toward the desk, resting the arms on it, thus bringing about a most undesirable position of the whole body.

It is apparent, therefore, that of the two kinds of desks the one that is too low is the cause of more injurious conditions.

If the chair is not of correct height, faulty adjustments also take place. There must be room for the legs, otherwise, varieties of positions will be assumed involving twisting of the trunk, and one-sided postures may result. These will be discussed under the consideration of lateral curvature.

In many instances it seems to be a case of adjusting the body of the individual to the furniture rather than of fitting the furniture to the individual. All the blame, however, should not be attributed to the faults of the furniture and its adjustment, for, even with the most ideal arrangement, attention should be directed to the correct way of sitting, and children be taught to sit as well as to stand properly.

Otherwise, slouchy attitudes will be probable. (Figs. 12 to 15).

The position of the hands and arms is important. Leaning forward, resting on one arm or on the elbows, should not be allowed. When sitting in a position of attention the arms should hang easily at the sides, with hands in the lap or on sides of the seat, or be loosely clasped on the edge of the desk. Folding the arms behind the back is undesirable, as it allows the body to slide forward in the seat and increases the lumbar curve.

Seats should be so adjusted that there will be no pressure under the knees upon the bloodvessels and nerves, and should, therefore, have a depth several inches less than the length of the thighs. The height of the seat should be such that the feet may rest easily upon the floor, with the ankle-, knee- and hip-joints bent at right angles. The seat should slope slightly downward, from front to back, and the back support be relatively low.

Desks.—The height of the desk should be such that the forearm may rest easily upon it with the elbow bent at right angles and the shoulder neither elevated nor depressed. The most desirable slope for the desk has been found to be about 15 degrees.

It seems probable that the old style adjustable desk bids fair to be superseded by the more practical, comfortable and easily adjustable furniture worked out and placed on the market by the American Posture League. This type of furniture has many advantages. It is not fastened to the floor and thus can be arranged in better relation to the teacher, or can be removed easily. Books are kept in a drawer under the chair seat. The desk and seat are easily adjusted by means of screws which can be turned by hand and do not necessitate the use of tools. The seat is slightly

hollowed from front to back with an opening at the back for the buttocks. These seats are made in several sizes, and a factory chair is also made.

Proper seating is not so much for the support of the spine as for the support of the pelvis, in order that its proper relation to the spine may be maintained. It is possible to sit poorly in the best adjusted seat or to sit fairly well in a poor seat. Much depends upon the individual effort and the importance that one attaches to the matter.

The value of teaching the fundamental principles of sitting correctly in any sort of chair is evident from the fact that most of the furniture used in our daily avocations is not adjusted to our needs. "Sitting *down*" is quite expressive of the usual method: the body segments collapse, the hips slide forward in the chair, the back is bent like a bow, and the muscles of the trunk relax. Why not "sit *up*" instead: the feet resting on the floor, the hips pushed back in the chair as far as possible, thereby making a firm point of support for the spine, with the body held erect and easily poised by the tonic contraction of the supporting muscles.

Writing Position.—The old method of slanting writing, and the manner of sitting thus made necessary, was undoubtedly productive of a certain amount of incorrect posture. In most schools the system of writing now in use requires the child to sit squarely at the desk, feet on the floor, arms resting on the desk, elbows bent at right angles. The left hand guides the paper, and the direction is given to write, making the movements on the "fat muscle" of the arm, "in and out of the sleeve." There is, in this position, no necessity for turning the head, as the writing is plainly visible, and a writing lesson may be made an excellent opportunity for the practice of good, sitting posture. Care should be taken to prevent leaning forward heavily on the arms, and a crouching position avoided.

Defective Eyesight and Hearing.—These may contribute their quota to a faulty posture. An individual who has defective vision will lean forward in the effort to see the work or the blackboard, and the same effort will be made if the hearing is impaired. If a persistent tendency is shown to push the head forward or to round the shoulders, it should arouse suspicion in the mind of the teacher, and the vision and hearing should be tested. In this connection the lighting of the school room is important. There should be no dark corners.

Carrying Books to and from School presents one of the greatest of the school problems with which we must deal. Children often carry five or six pounds of books daily, sometimes for necessary study, and sometimes, because in our congested schools, where two sets of classes are in session daily, there is no safe place for the pupil to leave books. In many of the schools, lockers are being provided, so this need will be met. Books are carried in every conceivable way: in a bag over the shoulder, in a case, on one hip, under the arm, etc. Each individual adopts a method, and then is liable to form a routine or fixed habit. The best arrangement for meeting this difficulty, but one which does find much favor, is to use a bag like a knapsack, with straps over both shoulders; the next best is for the child to carry books on alternate days first on one side, then on the other. Two sets of books, one at home and one at school, would solve the problem.

The Teacher's Posture.—As the force of example is great, the teacher needs to appreciate the significance of the posture and appearance which she presents before the class. The young are quick to imitate, not alone desirable qualities, but often peculiarities of dress and manner, or the attitude of instructors whom they observe. It behooves

those who occupy such positions, to consider their responsibility in setting high standards, which is an important part of their educational program. Children are severe critics, and frequently one may hear a child say, with an accompanying illustration of the posture observed, "You ought to see my teacher; she stands this way!"

Teachers, especially those of physical education, should embody in themselves the mental and physical poise which they strive to impart, otherwise their teaching will not be effective. The reaction upon a class of the teacher's mental state, as expressed in terms of posture, is too important to be ignored. A depressed mental state at once produces a tendency to relax the whole body. This depression and relaxation is transmitted to the individuals in the class, and the inspiration to effort is lost. The stimulating influence of a teacher with an erect bearing and enthusiastic manner cannot be overestimated.

THE PARENTS' RESPONSIBILITY.

While the schools and teachers have responsibilities to bear in regard to the child, that of the parent is greatest of all, and often is the one least appreciated and assumed. Many parents are ignorant in regard to the faults to which children are susceptible while growing, the predisposing causes and the influence of home surroundings. It usually lies in the power of the parent to exercise such preventive measures that the corrective need will be reduced to a minimum.

The first parental duty is to provide general hygiene: proper food, plenty of fresh air, sufficient sleep on a low pillow in a well-ventilated room, and time for recreation. Many parents attend conscientiously to these and other

details, but are not awake to other equally important factors in the every-day environment of the child which may have a bearing upon the proper growth and development. They often complain despairingly, for example, that their children sit at the table in atrocious postures, without ever having given any intelligent thought to the possibility that the chair seat is not high enough for the child to reach the table comfortably or that the feet are unsupported and the legs dangling. Correct seating for study and for piano practice is often overlooked. Attention should also be given to the arrangement of light for study and reading.

Clothing.—The influence which clothing may exert upon posture is a subject to which the attention of the parent should be directed. The underwaists worn by many children are supported by straps which pass over the outer point of the shoulder and the head of the humerus, which is movable. The garters are attached below, in front, so that there is then exerted an elastic downward drag, so strong, that many times the child is unable or unwilling to make the muscular effort necessary to counteract the tendency to the forward pull, and a stooped attitude results (Fig. 16). There are waists now on the market which obviate this feature, by having shoulder straps placed so that the pull comes over the shoulder girdle, higher up on the neck, and the shoulder-joint is left free.

It is of noteworthy interest to learn from the experience of both children and parents, that the ability to stand up better exists when socks are worn, for the child is thereby relieved of the garter pull. It would surprise one, who has not had attention called to the matter, to observe the amount of tension that can usually be found in the elastic of the garters, which means a constant downward pull on the shoulders.

The development of the bust in growing girls may have a distinct influence upon posture. Sometimes the increased weight of the breasts is sufficient to draw the shoulder girdle forward and downward, or to increase a forward tendency already established. More often, however, adolescent psychology is at the root of the difficulty. Many girls at this time are supersensitive and consider this normal growth a cause for embarrassment. There is a desire for concealment and a relaxed posture of the arms and shoulders is cultivated for the purpose. Added to this, fashion dictates the "flat, boyish figure," and a tight brassiere is worn, most pernicious in effect, retarding development and causing the busts to become flabby and pendulous. The solution of this problem should give mothers and teachers food for earnest thought.

With girls, the arrangement of hair may constitute a contributory factor necessary to be considered in combating faulty posture. If there is a tendency to a forward position of the head, the effect of a bunch of hair held at the neck by a large ribbon is to push it forward still farther. The weight of a heavy mass of hair will produce the same result. Also caps, as worn by children in winter, pulled over the back of the neck and ears, or high collars on coats and sweaters, may have a similar effect. It takes only a slight suggestion to help in the formation of a habit, and several such suggestions form an aggregate which can exert considerable influence.

Again, boys' coats should not be too heavy. In one school a plan for having the boys remove their coats in warm weather resulted in improvement of posture. The investigations of the Posture League have brought out, in this connection, this most interesting point: that the majority of men's and boy's coats are made to fit over a display model

which is faulty as to the position of head and shoulders. Wearing such a garment actually induces poor posture, because if an erect position is assumed the coat wrinkles across the shoulders.



FIG. 16.—Type of underwaist worn by many children, exerting a strong forward pull on the shoulders.

Fashion.—The effect that fashion may have upon the voluntary assumption of certain postures is considerable. Impressionable girls see beauty in illustrations in the fashion papers, or—if we may use the expression—in a sort of “hero worship” strive to imitate society or stage favorites. The “debutante slouch” was an influence hard to overcome and sometimes became the despair of the teacher who under-

took to set up other standards which were not considered fashionable.

The young man also often sets up poor standards. A "slouch," for instance, is considered manly, and is often assiduously cultivated. The habit, also, of carrying the hands in the pockets has been universally recognized as having a tendency to promote an undesirable posture.

Shoes.—Shoes which are uncomfortable or ill-fitting are among contributory causes of the faults under consideration. Weak feet and misshaped shoes which afford inadequate or unequal support to the body, thereby promote faulty posture to say nothing of the extreme discomfort endured. The shoe with the high heel and pointed toe necessitates an entire readjustment of the segments of the body which are superimposed upon the foot and produces some of the most unsightly postures. Alteration in the position of the base of support, the foot, from horizontal to slanting, which necessarily results from wearing the high heel, disturbs the center of gravity, changes the weight distribution, throws the body forward, tending to flex the knee, and other adjustments must follow in the altered positions of the pelvis and spine. One of the most common of the deformities produced is lordosis.¹

Above all, the parent can make sure of conditions and tendencies in no better way than by a periodic examination of the child undressed, and although this should be part of the established routine, nevertheless it is rarely done. Seeing an individual regularly, day after day, in clothing, the eye does not appreciate defects until they become fairly pronounced. There is no garment which more effectually disguises the lines of the figure than the "middy

¹ This subject is discussed more fully in the chapter on the Feet.

blouse," so universally worn, falling in a straight line from the neck.



FIG. 17.—A condition concealed by the disguising "middy blouse" and arrangement of the hair.

In addition, a girl's hair arrangement is often such as to complete the delusion of a good posture, by filling in the back of the neck, so that the casual observer thinks the

child quite erect, and the astonishment of parents is frequently great, when clothing is removed, and attention is called to the actual condition (Fig. 17).

There is no doubt that the youth of today is very much overtaxed, not alone by the duties of school and home study, which leave too little time for play and healthful activities, but also by the demands of present-day civilization. It does not seem fair that the requirements should be so great at the critical period of growth and development as to tax physical and mental powers to the utmost. In view of these exactions, how can we blame them so much for faulty posture? Consider for a moment the following schedule: School and home lessons, music lessons, possibly one or two foreign languages to be acquired, dancing school, frequent visits to the dentist for the tedious process of having teeth straightened, and, it may be, one or two lessons a week in individual gymnastics. This is not an extreme picture, but one which in the experience of the writer is not at all uncommon or overdrawn. It is the duty of the parent to take this question very much to heart, and to simplify life as much as possible for these growing and developing children. Let them not be too ambitious for prowess and achievement, gained, too often, at a sacrifice of health and strength.

As posture is influenced to a great extent by low vitality and fatigue, then, if the demands upon the young can be lessened, and more time be given to free play and recreation, the general condition will be improved and we have established a foundation upon which to build an efficient mechanism, one which shall "raise the mean" for the next generation, and good posture will come as its natural sequence or result.

CHAPTER VI.

EXAMINATION—RECORDS—THE SCHEMATO- GRAPH—TREATMENT—POSTURE DRIVES—POSTERS.

METHOD OF EXAMINATION OF ANTERO-POSTERIOR FAULTY POSTURES.

Preparation of the Pupil.—The pupil should be entirely undressed when possible. At the least, so much of the clothing should be removed that the trunk will be exposed to the level of the great trochanters, in order that the line of the hips and the gluteal fold may be revealed. Otherwise it is impossible to observe the relationship of the parts of the body to one another or to make any examination other than a most superficial one, that is liable to lead to an erroneous diagnosis.

The hair, if long, ought to be so arranged that the lines of the neck are observable.

There should be no clothing or bands around the waist.

The shoes should be removed.

The pupil should stand with the weight on both feet, arms hanging at the sides of the body, and exposed to a strong light falling in such a manner that the shadows are equal.

The teacher's manner should be quiet, business-like, and such as will put the person who is being examined at ease. The creation of a matter-of-fact atmosphere is requisite.

Marked comments upon the result of the examination, in the presence and hearing of the pupil are far from advisable

from any point of view, in fact, such comments are most objectionable.

Since embarrassment and nervousness may cause exaggerated positions to be assumed, it is well to allow the pupil to stand quietly for a moment or two, observing the position carefully, meanwhile, until it becomes relaxed. There should be as little handling as possible, as this tends to produce nervous reactions and self-consciousness. The examination should be conducted quickly, though not hurriedly, in order to avoid fatigue.

During the examination use, if possible, some kind of a garment which is simple and may be easily laundered. For this purpose we would suggest taking merely a long strip of outing flannel, making a slit about a foot long, cut lengthwise through the center for the head. This covers the body sufficiently and can be easily adjusted for the examination of any part of the trunk.

Points to be Noted in Examination.—The examination should be made from the front, from the back, and from the side, so that the body may be seen in all its aspects and the following conditions noted:

1. General hygiene and muscle tone.
2. Feet: Any abnormalities—strength of arches.
3. Knees: Hyperextended or flexed.
4. Abdomen: Relaxed—prominent, or otherwise abnormal.
5. Chest: Flat, narrow, depressed, or otherwise abnormal.
6. Shoulders: Position.
7. Scapulæ: Prominence—position.
8. Position of head.
9. Exaggeration of normal physiological curves (kyphosis—lordosis).
10. Type: Stiff—flexible.

11. Posture, estimated by the above data and by observation of the weight-distribution as indicated by the deviation of the body segments from the straight line axis. Diagram (Fig. 18).

A method of estimating posture quickly, and one which is of value in the school room where numbers fully dressed must be dealt with, is the "window-pole test."¹ Appreciating the fact that the axes of the body segments should form a series of straight lines, if a straight object such as a window-pole is interposed between the eye and the posture to be judged, comparison can be made quickly. While this test does not take the place of the detailed examination, it is helpful, makes a basis for grading posture in the school room, and arouses the interest of the pupil.

Methods of Measuring and Recording.—These methods are various and of relative value. From time to time, mechanical devices have been invented, many of them good, but the principal objections have been that they were either too expensive to be generally adopted, or were so complicated of adjustment as to fatigue both the pupil and the observer.

Measurements taken on the skin with a tape-measure are unsatisfactory, because the skin moves so readily over the underlying bony structures. The inability to hold the body steady, and the difficulty of reproducing with exactness the same conditions as at a previous examination, add other elements of inaccuracy in records derived from the use of the tape-measure. These considerations have forced the conclusion upon most of those interested in the subject, that some general picture of the condition, is of greater value than a series of measurements in terms of inches.

Tracings of the figure by means of the pantograph have been used to some extent.

¹ Bancroft: *The Posture of School Children*.

Another method in use by some, is to obtain contours of the back by means of a flexible lead tape, and this, outlined on cardboard, serves as a record, subsequent drawings being superimposed and improvement noted.

Method of Grading Posture.—It would be helpful if posture could be graded on a percentage basis, especially as an incentive to the pupil, to whom the points of deficiency would thus become more tangible. On the assumption that postures fall into four groups as regards degree (A, B, C, D)—deficiencies noted in the examination may be estimated by the teacher in terms of grades, points or percentages. This grading would be, at best, only relative, as any marking of this sort is influenced by the standard set by the individual teacher.

A method, strictly empirical, being tried by the author, is given herewith. Assuming A = 20 points = 100 per cent, credits are as follows:

Head	3 points
Chest	3 "
Dorsal curve	3 "
Lumbar	3 "
Abdomen	3 "
Weight-distribution	5 "
<hr/>	
20 points	

The following diagram is self-explanatory. (Fig. 18.)

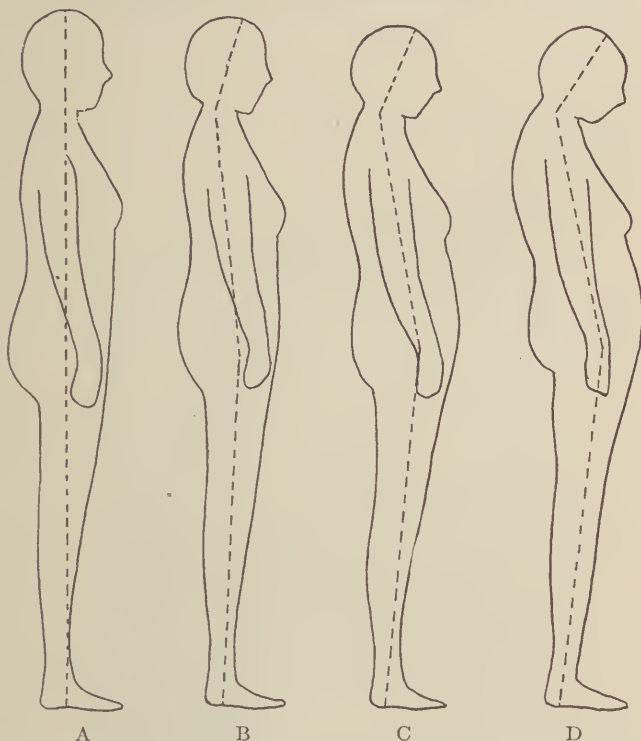


FIG. 18.

Grades	A	A -	B +	B	B -	C +	C	C -	D +	D	D -
Points	20	19	18	17	16	15	14	13	12	11	10
Percentage	100	95	90	85	80	75	70	65	60	55	50

Photography.—Photography, is perhaps, the best means of showing the existing condition, but it has not been generally used except in special cases, for the reason that the difficulty exists, not only of overcoming embarrassment, but also of the identification of the individual and of expense.

The Schematograph.—The schematograph is an apparatus invented by Dr. Cleila Mosher and Professor Lesley, of the Leland Stanford Junior University, California. As its name implies, it is for drawing the form, and has been employed with much success as a quick, graphic method of recording outlines of the figure. In appearance, this instrument is much like a camera with a focusing lens. It has



FIG. 19.—The schematograph.

an arrangement of mirrors by which an image is thrown upon a sheet of clear glass, on which is superimposed a piece of tracing paper. The manner of using this apparatus may be briefly described as follows:

The pupil stands about ten feet distant, against a dark background, and in a bright light. As originally planned, the apparatus and operator were to be in a dark room, such

as a closet, with a hole in the door, through which the lens protruded. This arrangement is desirable for its mental effect on the pupil, who feels less under observation, and consequently stands more at ease. As a substitute for the dark room, a folding screen may be used, enclosing the schematograph on three sides, a hole cut in the center fold for the lens. The operator then stands behind with a black cloth thrown over the top of the screen and head. This arrangement has answered admirably. The image thrown on the tracing paper is then outlined with a soft pencil. In a short time, quite a knack is acquired in holding the hand steady, and in making the drawing, or "schematogram," quickly and accurately (Fig. 19).

There are several features which recommend the schematograph for the purpose above stated; the pictures are inexpensive (only a few cents each); the personal reserve of the pupil is maintained, and while the individuality of the face is eliminated, defects of posture are recorded.

This apparatus is useful for the purpose of making routine measurements of large groups of individuals, as in a college, as by this means, a record of the posture can be added to the physical register of each student. The drawing can be made in two or three minutes. Again, as a means of arousing interest in the individual and as a stimulus to effort toward improvement, this invention has been found excellent, for the student can be given, as a guide, a duplicate copy, which can be made in a moment, with indications or markings thereon, showing where improvements are desirable. From time to time the record is taken again and comparisons made.

The criticism has been advanced that this record is not accurate. It is not claimed to be exact, as it must be subject always to the personal equation of two people. Yet, as a general picture of the individual, it becomes a useful addition to our records.

The prevalence of poor posture among college students is



FIG. 20.—Schematograph records of posture, showing improvement in six months.

quite generally recognized and its correction one of the problems that besets the teacher of physical education. By the

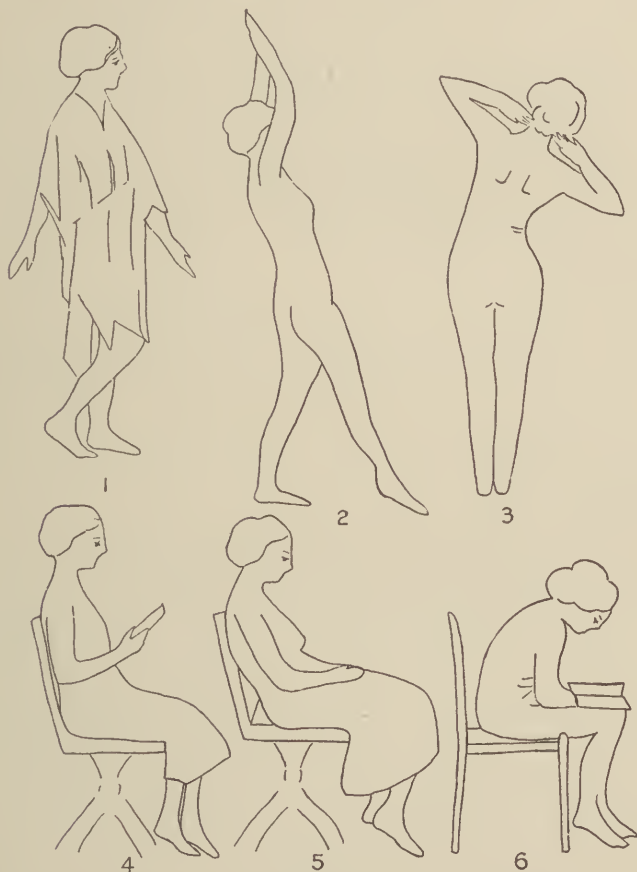


FIG. 21.—The possibilities of the schematograph for purposes of illustration. 1 and 2, dancing postures; 3, an exercise; 4, 5 and 6, sitting postures.

use of the schematograph, it has been possible to obtain numbers of drawings for study, from which deductions have been made (Fig. 20). Interesting studies in clothing can be

made also, and the possibilities of the use of the schematograph by the teacher for illustrative purposes are many (Fig. 21).

It has been found that faults of posture exist among men as well as among women students. Dr. Lloyd T. Brown, in his study of over seven hundred men at Harvard College, says that "80 per cent of the group stood in either the C or D class of posture, while only 20 per cent of this selected group of educated men stood with their bodies in a normal or nearly normal position."¹

Studies made by the writer of a corresponding group of college women were surprising in the similarity of results, as the percentages of faulty postures were practically the same and the prevailing type almost identical. This is the type familiar to all where the weight of the body rests on the heels, the abdomen is prominent, the shoulders round—the "slouch."

There is little doubt that the relation between faulty posture and health is very close. Among the women examined constipation was almost universal, menstrual pain and irregularity of frequent occurrence, and in most cases there was a falling below par of the general physical condition. Records showing improvement in these conditions after exercises had been taken for correction of posture, would seem to offer conclusive proof that these ills could be attributed to faulty bodily mechanics.

TREATMENT.

The lines along which it is essential to work for the improvement of these conditions are as follows:

1. The removal of predisposing causes.

¹ Brown, L. T.: A Combined Medical and Postural Examination of 746 Young Adults.

2. The establishment of good hygiene.
3. "Mental set" of the pupil (a desire to improve and determination to persevere).
4. Exercises.

The Removal of Predisposing Causes.—This necessitates a careful survey of the environment of the individual; an inspection of the clothing and its adjustment, observation of habits of work and play, and investigation of postures in standing, sitting and sleeping. This should be followed by helpful suggestions.

With young children, the attention of parents should be called to the importance of these matters, and their co-operation enlisted. The investigation of school conditions should be made also. Many parents need enlightenment, and should understand from the outset that it is not sufficient for the child to be sent to a teacher for special exercises once or twice a week. It is too often the case that the teacher is expected to perform miracles when the exercises oftentimes are the least part of the program of correction and only supplement the more important efforts for which the parent is responsible. When it is appreciated that the home-training of the child should emphasize the proper carriage of the body in standing and sitting, and that insistence upon this is as important to the hygiene and welfare as the care of the teeth and the daily bath, then we shall have taken a long forward step in preventive measures. As "preventive medicine" is superseding what may be designated as "corrective medicine," is it too much to hope that the time is at hand when such measures may be taken in the prevention of the formation of faulty posture habits, that the necessity for corrective treatment will be reduced to a minimum?

Good Hygiene.—This is essential in order that the organism may be in the best condition possible, that the muscles may

be strong enough to support the structures in their correct interrelation, that there shall be no undue fatigue, and that there is an abundance of energy and vitality. Frequently the establishment of improved hygiene is all that is necessary in treatment. Attention should be directed toward the healthy functioning of organs, and advice given in regard to food, exercise, elimination, and sleep. One authority says that "ten hours sleep should be insisted on in treatment."

The Mental Attitude.—This is a dominant note in the treatment. It has been mentioned previously that unless an individual desires to improve, is willing to make a distinct and persistent effort, little result can be expected. The teacher has no power of "laying on of hands" by which it is possible to effect a cure, no matter how greatly such a gift is desired. It must come through the conscious effort of the individual. The teacher can but show the way and use ingenuity to awaken interest and stimulate effort.

Having removed causes, as far as possible, and established a better hygiene for a pupil who is earnest and interested, we may, with advantage, proceed with the treatment by exercises.

Exercises.—The first consideration in planning a program of exercises is of the type of case, whether stiff or flexible. In the former condition, exercises should be given to stretch contracted tissues, thereby restoring more normal flexibility. In extreme conditions, passive exercises will be effective and necessary. After this the improvement of muscle tone and reëducation of the muscle sense follow.

With the flexible type, no time need be spent in giving exercises to increase flexibility; in fact, care should be taken to select exercises that will not produce the overstretching of muscles already relaxed. A case in point would be the routine use of the exercise known as "hanging from the bar,"

excellent for a stiff back, but ill-advised if used for a flexible one.

Much of the work is in training the sense of position, for the problem is practically solved when a pupil learns how to make the adjustments necessary to obtain the correct position, and perseveres in this effort until the muscles become strengthened and the position can be held permanently. *The best exercise for posture* is the unremitting assumption of correct posture.

Braces are worn sometimes but are not advisable in the majority of cases. The individual sinks into the brace and relies on it to do the work of the muscles, which consequently become weakened and still less able to hold the body upright. If a brace is worn it should be merely supplementary to the gymnastic treatment and be used only at such times as it is probable that poor positions will be assumed, as in school. Braces are difficult of adjustment and many of the ready-made ones sold in stores and advertised in glowing terms, do more harm than good and should be avoided. They may correct one fault while producing another which is as bad if not worse than the first. Many of them cause lordosis. In case a brace is thought necessary it should be made to individual measurement by an expert, preferably under the direction of an orthopaedic surgeon.

METHODS OF STIMULATING INTEREST IN POSTURE.

Recognizing that good posture is of far-reaching importance, and that its acquirement should be basic in any educational program, the teacher of physical education is confronted with the problem of selecting the means to be employed in arousing among pupils of all grades in schools and colleges an effective interest in the subject. Unless

incentives to systematic effort are found, satisfactory results cannot be obtained. In reference to the importance of interest accompanied by effort it has been said: "It is only when they help each other that our work reaches perfection. To be interested without effort is to be entertained, to float with the current; to exert effort without interest is to be wearied, to row against the current; but to be interested with effort is to enjoy what is being accomplished, is to be steering for my destination while the current favors my progress."¹ As the methods must vary to fit conditions and ages, there is scope for considerable ingenuity. Some of the schemes which have been tried out and found of value will be outlined.

It is always wise to give simple instruction to any group and present the subject in such a logical way that good posture will appear as a thing desirable and not compulsory. Pictures and posters may be shown to illustrate good and poor postures, and deductions may be drawn by the pupils as well as by the teacher. The former should be encouraged to criticize freely, but always in a friendly spirit, the postures of their companions. Popular talks illustrated by a stereopticon can be made interesting to any group. It is fairly easy to have slides made, or they can be hired at a nominal expense.²

In the elementary schools a method originated by Miss Bancroft has been used successfully. In this posture is made a subject of individual, class and school pride. Based on the "triple posture test" the class is divided into Group I, Good Posture; Group II, Poor Posture. Grades are given and names are written on the board. The incentive is for

¹ Prof. Horne: *Philosophy of Education*.

² American Posture League, 1 Madison Avenue, New York City; National Board, Y. W. C. A., 600 Lexington Avenue, New York City. Lantern slides can be hired from both organizations.

Group I individuals to keep up their standard, and for Group II individuals to be promoted as soon as possible. This scheme is carried still further by competition between classes, and finally becomes a school honor as well. Similar methods are being tried out in many schools by a system of reward—marks or badges of honor are given, and in one educational institution where colored “chevrons” were awarded, the effort made was astonishing.

In most colleges it is now the custom to make good posture one of the requirements for eligibility to membership in the athletic teams. Students in some of the New York high schools and in the training school for teachers, have been given demerits for falling below the standard, and special work has been required until the posture mark was raised, before graduation was allowed.

A pin has been designed by the Posture League which can be purchased and awarded provided certain requirements are fulfilled.

With older college girls the problem has been met in a rather satisfactory way by a “posture drive,” calling attention in emphatic ways to the subject. One of the most typical of these was carried out at Vassar College a short time ago. It is herewith described in full as being an excellent model.¹

The drive took place during the week before the spring holidays, being announced in the college paper in various interesting and amusing ways several times prior to the event:

First Day.—Posture tests were given instead of the regular lesson.

Second Day.—Exhibition of posture posters.

¹ Originated and given by Miss Mary Catlin. Printed by permission.

Third Day.—1. Parade of students at noon, girls “slumping” badly and carrying posters visited every dining room and announced exhibits.

2. Announcements in college paper, amusing poems, etc.

3. Two “four-minute” speeches on the way to and from chapel, the girls chosen standing on soap boxes, and having been trained in public speaking, addressed the crowd of students on “posture” and “shoes.”

Fourth Day.—Posture tag day.

1. About forty students (girls who had passed the posture test previously and who stood and walked well) acted as Posture Policemen. They wore S. U. S. badges—Stand Up Straight—and it was their business to tag anyone who did not stand, walk or sit properly. Before the first class in the morning they lined up outside the recitation halls and made everyone walk between them.

2. More posture tests were given in class.

Fifth Day.—Each girl received a card in her mail box bearing the following inscription:

SIT UP STRAIGHT
 STAND UP STRAIGHT
 Stick me in your mirror
 Or pin me on your door,
 If you live me, you will look
 Much better than before.

Sixth Day.—Posture tests, and

“Write up” in the college paper.

During the drive, signs made by the girls were posted around the campus and in the dormitories. Many of these were “take-offs” of the titles of some of the popular plays, such as “the thirteenth chair,” for the girl with the hollow chest. “Redemption” of posture is what we want! Even

the crooked trees were admonished by placards to hold themselves straight.

Each year some special effort is made to improve posture. A previous experiment was to appoint as a committee several of the students with good posture, each of whom observed for two weeks, without their knowledge, the postures of certain members of the class, averaged the marks and passed them to the instructor, on cards printed for the purpose.

Name,	
Grade,	
A. Posture habitually	correct.
B. Posture	“ fair.
C. Posture	“ poor.
Date,	Name of Judge,

As appears in an earlier part of this chapter, the use of the schematograph has been found valuable as a means of creating individual interest. In the beginning, when this method was new, word passed from mouth to mouth among the students that a very unusual proceeding was taking place in connection with the regular measurements required by the college; soon the unusual phase passed to one of interest and each student became curious to see her own “graph.”

These drawings have the advantage of eliminating the personal element to such an extent that they can be shown and compared with freedom. The outline having been drawn, the teacher indicates to the student the conditions to be improved, such as the forward head, the rounded shoulders or flattened chest, making a few general suggestions, and drawing improved lines with a colored pencil on the original, a copy of which is given to the student for reflection and guidance.

At a “posture week” recently the suggestion was made that it would be of interest to the general public to see the

schematographs of their postures. These were taken in clothing and the results were astonishing, as faults were revealed strikingly, and people were much impressed. From this the idea of a silhouette was evolved. A tracing of the schematogram was made on black silhouette paper (white on the reverse side), the outline was cut out and pasted on a white card, and a striking silhouette was produced, taking only a few minutes to complete.¹

POSTERS.

Posters may serve a two-fold purpose in directing attention to the subject of posture: First, as a piece of research work for normal students in physical education, the making of a posture chart necessitates constructive thinking and gives scope for much originality. After instruction has been given on the subject of posture, each student is asked to design a poster which shall express in the most emphatic and striking way possible some central idea and not be just a collection of unrelated pictures of posture. It adds to the interest and calls attention to another subject of importance, to have some of the posters made with "feet and shoes" as the central motive. The interest becomes keen and the necessary search for pictures to illustrate ideas and for "slogans" which shall be appropriate and effective requires considerable thought. One does not need to be an artist in order to construct a poster, since pictures can be collected from various sources and utilized—for instance, newspaper illustrations have been made into some very striking ones.

Posters are made on large sheets of cardboard of uniform size and color, furnished by the college, and are then placed

¹ Originated by Miss Emily Andrews, Central School of Hygiene and Physical Education, New York City.

on exhibition. They are voted upon and marked by a committee, and credit given, just the same as for any other required work. The exhibition is advertised, all departments of the college are invited, and undoubtedly their interest in the subject of posture will be thereby aroused also. Secondly, the posters may be used to illustrate lectures and for class-room propaganda, for various groups and on many occasions.

Not only is the making of posters useful for college students, but this plan could be used to advantage in any school, from highest to lowest grades, and if made competitive would be of even greater interest.

Rhymes and poems with appropriate allusions often catch the interest, as experience with "The Ode to Posture" will show. This poem was circulated first among a small group of students, by one of whom it was composed. It has, however, gradually become widely known and during the past few months applications have been made for its use by more than one hundred schools, social and industrial organizations from all over the country. A most encouraging sign from the demand is, that it shows an universal effort to arouse interest in this vital subject (Fig. 22).

In another instance, a Posture Week was designated as a "P. E. P." drive. Interest was aroused in advance by posting the announcement, and a small prize was offered for the best interpretation of these letters. In this school "Posture Expresses Personality" received the greatest vote.

ODE TO POSTURE

Good Posture is an asset
Which very few possess;
Sad to relate, the favored ones
Seem to be growing less.



We see the folks around us
All slumped down in a heap,
And the way that people navigate
Is enough to make you weep.



Some elevate their shoulders,
Some hollow in their backs,
Some stiffen up their muscles,
And some just plain relax.



The one who walks with grace and poise
Is a spectacle so rare,
That even down on gay Broadway
The people turn and stare.



If you would cut a figure
In business, sport, or school,
Just mind the Posture precepts,
Obey the Posture rule.



Don't thrust your head out turtlewise;
Don't hunch your shoulders so;
Don't sag, and drag yourself around;
No style to that, you know.



Get uplift in your bearing,
And strength and spring and vim;
No matter what your worries,
To slouch won't alter them.



Just square your shoulders to the world,
You're not the sort to quit,
"It isn't the load that breaks us down,
It's the way we carry it'".

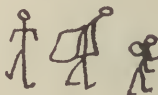


FIG. 22

CHAPTER VII.

EXERCISES FOR THE CORRECTION OF FAULTY ANTERO-POSTERIOR POSTURE.

THE exercises given herewith have been selected from a large number as representative of the types used in planning programs for individual work. From these suggestions supplementary exercises can be added and programs planned to meet individual requirements. (For general directions, refer to Chapter II.)

ORDER OF EXERCISES FOR PROGRAM.

1. Introductory: Breathing, relaxation, posture training.
2. General flexibility.
3. Local flexibility.
4. Self-correction (at mirror).
5. Strong back exercise.
6. Abdominal exercise.
7. Relaxation (hook lying position).
8. General strengthening exercises in the corrected position.
9. Posture training.
10. Walking in good posture and balance exercises of varying sorts.
11. Relaxation.

Generally.—It is important to pay attention to the position from which the exercise is being done, as well as to the movement itself, since an exercise, otherwise excellent, may fail in its result if performed from a poor starting position.

The teacher should have a thorough understanding of kinesiology in order that the exercises may accomplish the correct aims, and emphasis be placed upon the use of the proper muscles. The relation of motor to antagonistic muscles must be appreciated, and care taken that the return to position after a good exercise does not necessitate strong contraction of opposing groups of muscles which already may be overstrong. An illustration in point would be the exercise shown on page 111 (Figs. 41 and 42). The object is to strengthen the rhomboid muscles, necessitating a strong pull downward. A fault often observed is of emphasis on the upward push and the arms falling by gravity, and thus the aim of the exercise is nullified.

The purpose of corrective exercises should be twofold: *habit-freeing* and *habit-forming*. If the purpose is to overcome habits of poor posture, in order that habits of good posture may be established, the logical procedure is to discard old habits and to free the body from them. Then the habit-forming exercises can be given with benefit.

Daily occupations and activities encourage the forward position of the arms and the upward rotation and abduction of the scapulæ. Weak rhomboid muscles are almost universal. Also, overemphasis of the sitting position results in the weakening of the anterior trunk muscles, so in the effort to correct, it seems reasonable to direct attention to exercises which counteract these influences. Stress should be laid upon the trunk, abdominal and lower back exercises, and upon those producing adduction and downward rotation of the scapulæ, and less attention may be given to arm-raisings and extensions.

Fewer exercises are being given in the standing position and more value is found in those lying on the mat and in the sitting position. The body is freed and muscles streng-

thened without the problem of the mechanics of the upright position. These exercises should, however, be followed by intensive posture training and a few exercises in the standing position.

Appreciating the fact that the body is a segmented mechanism, with the base of support the feet, its proper adjustment must begin at this point. The individual should be shown how to carry the weight forward sufficiently to bring it over the arches. The knees must be neither hyperextended nor flexed, as their position influences the inclination of the pelvis, and this in turn controls the position of the spine. Considerable training should be given in pelvic control in learning the proper muscular coördinations.

Summary.

1. Habit-freeing exercises.
2. Habit-forming exercises.
 - (a) Exercises for pelvic control.
 - (b) Exercises for strengthening abdominal and trunk muscles.
 - (c) Exercises for upper back.
 - (d) Posture training.

Introductory Exercises.—These are of value in familiarizing the pupil with the work, in getting him into the spirit of it, and in imparting the feeling that he has discarded faulty adjustments and is building a new structure.

Begin each lesson with one or two vigorous all-around exercises which will stimulate the circulation and induce deep breathing. For example, a quick run around the room, spring-jump sideways with arm flinging sideways-upward (known as the “jumping-jack”), running in place and other energizing movements (Fig. 24).

Breathing.—Many people breathe improperly and insufficiently. When asked to take a deep breath they throw back

the shoulders, hollow the back, strain the neck and stiffen the chest by contraction of the muscles. The result is that the lungs are unable to expand except in a limited area and the breathing is very shallow. Definite instruction should

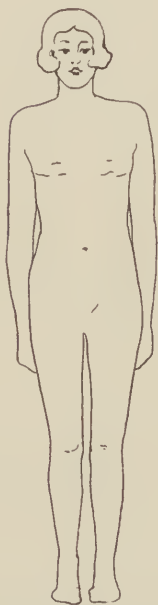


FIG. 23.—Fundamental position.

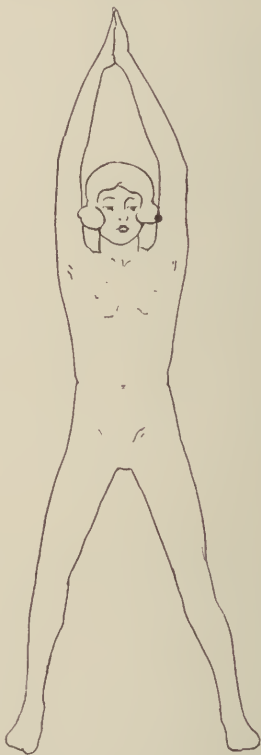


FIG. 24.—Jumping-jack exercise.

be given in regard to the proper manner of breathing. It is well to explain the necessity for keeping the chest flexible and free from tension, so that expansion may take place without forced muscular action. Slow, deep breathing is

then practised. One helpful device is to have the pupil place the hands lightly on the sides of the lower ribs and breathe deeply, so that the hands will be pushed out sideways indicating proper action of the diaphragm. This should be done without lifting the shoulders.

Exercises should be of such a character, and be done vigorously enough to stimulate deep breathing. This is a more desirable way of acquiring habits of right breathing than that of giving special breathing exercises. Care should be taken that a pupil is always breathing freely during the exercises and not "holding the breath." If he is unable to breathe easily and naturally, the exercise is probably too difficult and should be modified.

There should be free circulation of air in the gymnasium.

Relaxing Exercises.—These are given next on the program, in order to free the body as far as possible from habits of excessive muscular tension. The inhibition of muscular action thereby necessitated destroys the neuromuscular coördinations which have been formed by the faulty habits of posture. The muscles thus freed are ready to respond to new stimuli and other coördinations resulting in good posture may be established more quickly.

In the experience of the writer, the following relaxing exercises have been proved to be of definite value:

1. Standing Position: Trunk-freeing exercise. Relax the muscles of the neck, allowing head to fall forward. Relax the spine slowly until trunk swings forward from the hips. With knees extended swing trunk freely in all directions, allowing the arms to hang loosely. Then rise slowly to upright position extending lower back, upper back and finally neck and head, the teacher showing the pupil how to assume a posture of ease and balance, with no strain, at the end of the movement. Relaxing exercises as given in the funda-

mentals of dancing: "The crawl"; "the roll"; "folding and unfolding"; are especially valuable in this connection.¹

2. Stand Erect: "Arm-pendulum" exercise. Swing the arms from the shoulders like pendulums. Allow them to swing gradually more slowly, until they come to rest naturally at the sides of the body.

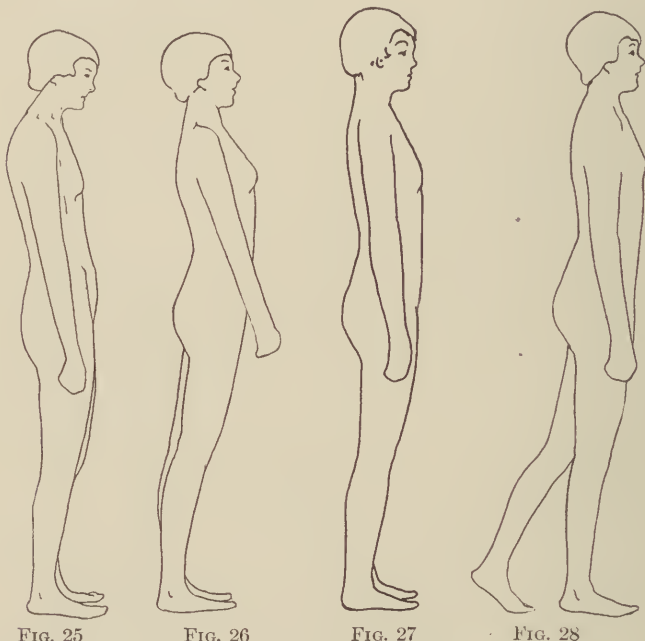


FIG. 25

FIG. 26

FIG. 27

FIG. 28

FIG. 25.—Poor posture.

FIG. 26.—Exaggerated and stiff posture.

FIG. 27.—Posture of ease.

FIG. 28.—Ease and poise in walking.

3. Stand Erect: "Leg-pendulum" exercise. Grasp a support with one hand. Swing each leg freely in all directions.

The bodily freedom attained by these and similar exercises is most desirable.

¹ H'Doubler, M. N.: A Manual of Dancing.

Music.—An asset to the equipment of the gymnasium is a Victrola, which may be used during certain parts of the lesson. It is especially good for accompanying these relaxing exercises. The psychological effect of the music is beneficial and is frequently a means of stimulating effort.

Posture should now be presented concretely and its full meaning explained. This essential may be taught by the excellent practice of first placing the pupil in the proper position, doing this several times if necessary, until, by “getting the feeling” gradually, he will be able to assume the posture through his own unaided effort. The body should be held as tall as possible without strain. There should not be any hollowing of the back, hyperextension of the knees, or tension in the neck. The weight of the body should be carried slightly forward over the arches of the feet, head up, and easily poised. Emphasize *ease* of posture (Figs. 25 to 28). As previously indicated, attention to the position of the pelvis is important. A helpful means of teaching the muscular coördination necessary to control the position of the pelvis, is to place one hand over the sacrum, pressing downward, and the other hand lightly on the abdominal muscles, suggesting a lifting of the abdomen and waist.

EXERCISES.

1. Passive chest-lifting (for increasing antero-posterior flexibility).

Position.—Pupil sitting on stool; feet on floor; hands at neck.

Movement.—Teacher grasps elbows and draws them slowly backward. Pushes forward with knee on dorsal convexity simultaneously. Relax. Repeat 10 to 20 times (Fig. 29).

2. Stretching chest muscles. Passive (for increasing flexibility) (Fig. 30).

Position.—Pupil lying on back. Pad under scapulæ.

Movement.—Teacher presses downward slowly on elbows until muscles are well stretched. Relax. Repeat 20 to 30 times.



FIG. 29.—Passive chest-lifting.

3. Stretching chest muscles. Active (for increasing flexibility) (Fig. 31).

Position.—Lying on back; knees bent; hands at shoulders, holding dumb-bells (1 to 2 pounds).

Movement.—Extend arms sideways, allowing weight of dumb-bells to exert a passive stretch on chest, at end of extension. Return to first position by

flexing the elbows, keeping the back flat, and chest expanded. Ten times.

4. Hanging from horizontal bar. (a) Active (for strengthening the back muscles).

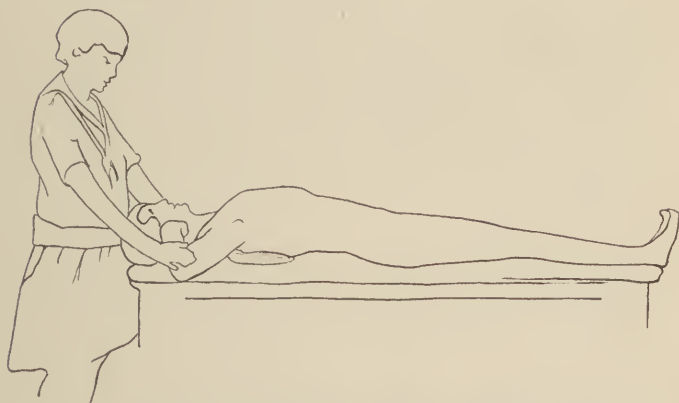


FIG. 30.—For stretching chest muscles.

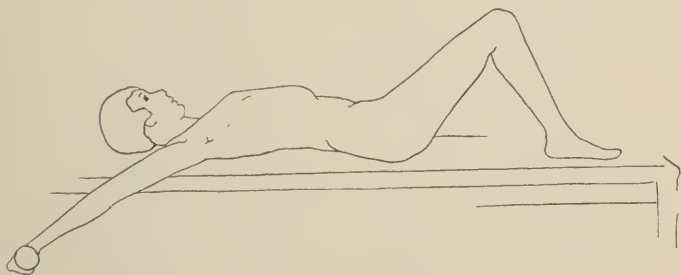


FIG. 31.—Arm extension sideways with dumb-bells.

Position.—Overgrasp, on horizontal bar; hands apart the width of shoulders.

Movement.—Suspend trunk from hands, with active tension of all the back muscles, without bending elbows, or pulling trunk upward (Fig. 32).

5. Hanging from horizontal bar. (b) Passive (for stretching muscles and extending spine) (Fig. 33).

Position.—Same as in Exercise 4.

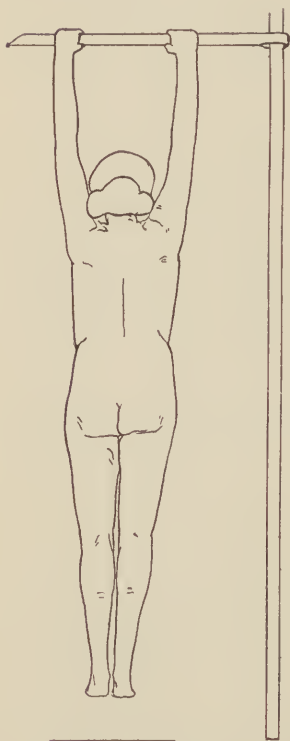


FIG. 32.—Active hanging position for strengthening the back muscles.



FIG. 33.—Passive hanging for stretching; note difference between active and passive hanging.

Movement.—Suspend trunk from hands, entirely relaxed, allowing the weight of the body to make traction on the spine.

6. Hand suspension, with forward push (for increasing flexibility).

Position.—Overgrasp on horizontal bar. Hands apart, the width of shoulders.

Movement.—Teacher places hands on scapulae of pupil and exerts strong push forward. Position should be held a few moments. Return to first position. Repeat 5 times (Figs. 34 and 35).

7. Prone-lying. Trunk raising (for dorsal flexibility) (Fig. 36).

Position.—Lie on face. Feet supported. Arms at sides of body.

Movement.—Raise head and shoulders backward. Rotate arms, turning palms outward. Hold position a few seconds. Return to first position. Relax. Repeat 8 to 15 times.

NOTE.—This movement should be localized in the cervical and dorsal regions and is inadvisable where there is a tendency to lordosis. It may be varied by changing position of arms, viz., hands on hips; hands at neck; arms extended sideways.

8. Exercise for round hollow back (Figs. 37 and 38).

Position.—Sit erect, astride plinth or stool. Hold wand in hands on knees.

Movement.—1. Swing legs forward until extended on plinth in "long sitting" position.

2. Simultaneously swing wand forward upward, arms extended overhead, and bend elbows, bringing wand behind shoulders.

NOTE.—Do not thrust the head forward or around the back.

9. Resistive arm flexion (for chest expansion and muscle-strengthening) (Fig. 39).

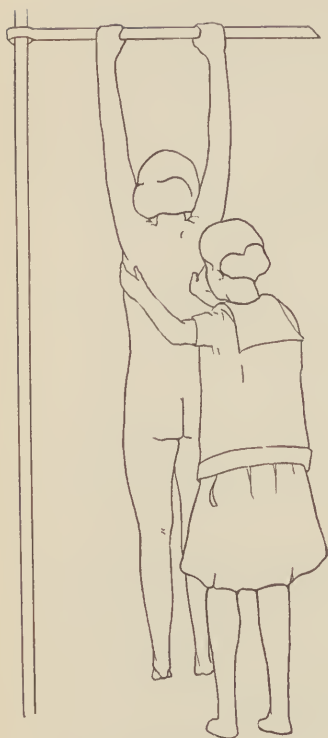


FIG. 34

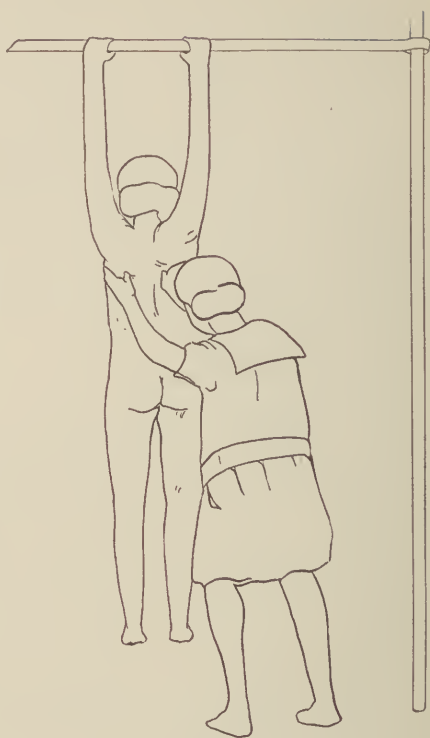


FIG. 35

FIGS. 34 and 35.—Hand suspension with forward push. Fig. 34, starting position; Fig. 35, the forward push.

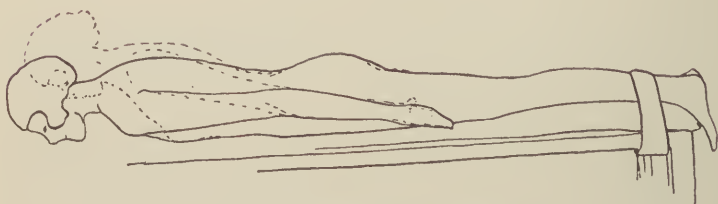


FIG. 36.—Prone-lying; trunk raising.

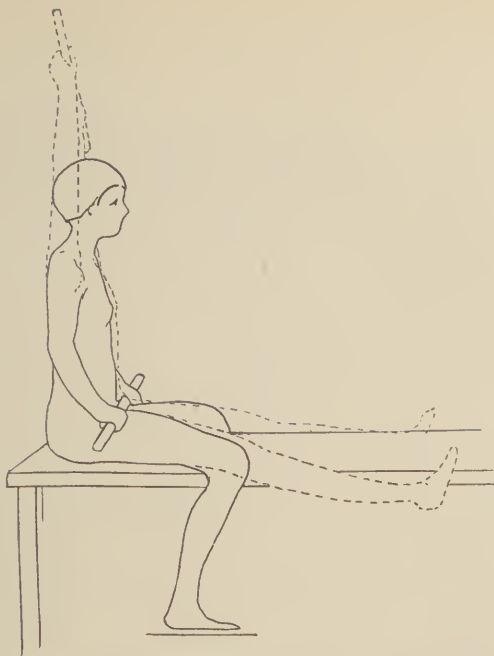


FIG. 37.—Continuous line. Starting position. Dotted line, intermediate position.

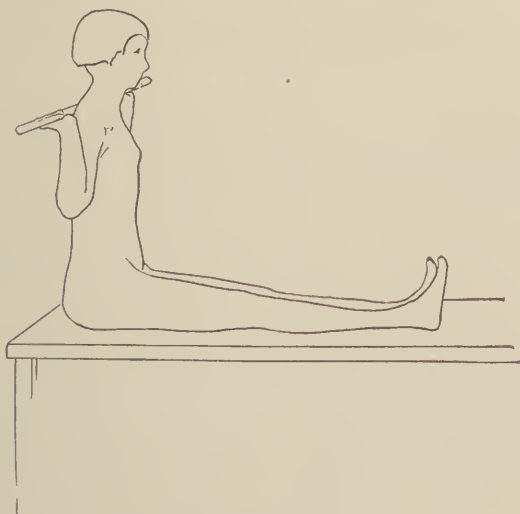


FIG. 38.—Final position.

Position.—Lying on back. Arms extended upward.

Movement.—Teacher grasps hands. Pupil pulls arms down, bending elbows, against resistance. Extend arms, without resistance. Teacher gives a strong pull on arms at end of extension. Repeat 10 to 20 times.

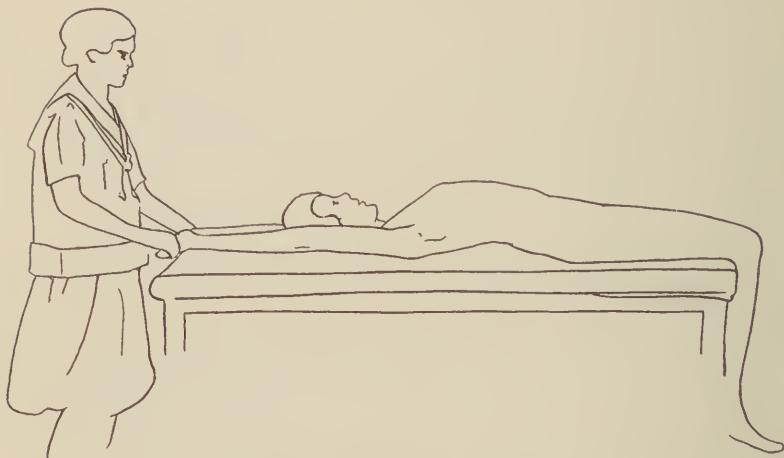


FIG. 39.—Resistive arm-flexion.

10. Arm and leg flinging exercise (general exercise) (Fig. 40).

Position.—Lying on back, on mat. Arms at sides of body. Legs extended.

Movement.—Fling both arms forward, upward, over head, until extended on mat. At the same time, fling one leg forward from the hip, until at right angles to the body. Return to first position. Same movement with both arms and the other leg. Repeat rhythmically 20 to 30 times or more.

11. Bar exercise (for strengthening the back muscles) (Figs. 41 and 42).

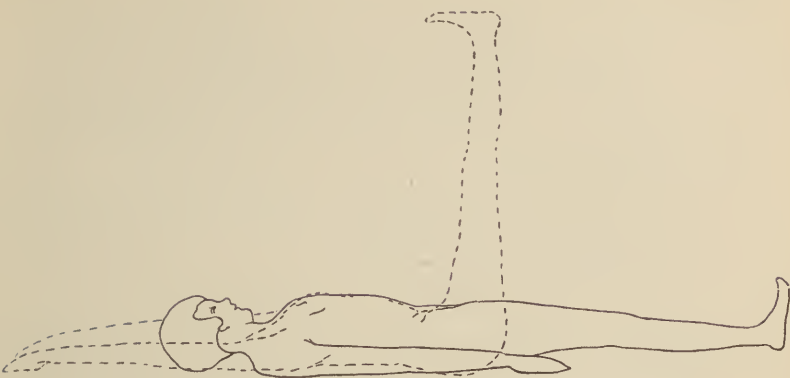


FIG. 40.—Continuous line position. Dotted line, the movement.

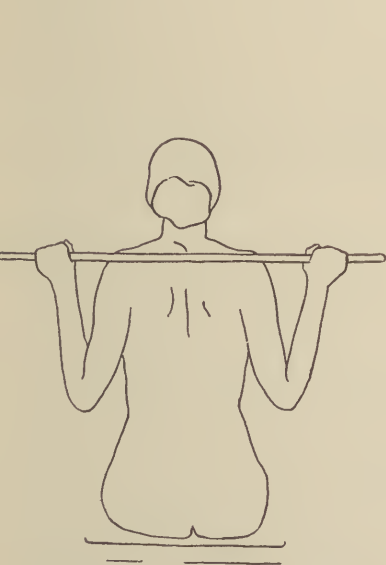


FIG. 41.—Position at start and finish of exercise.

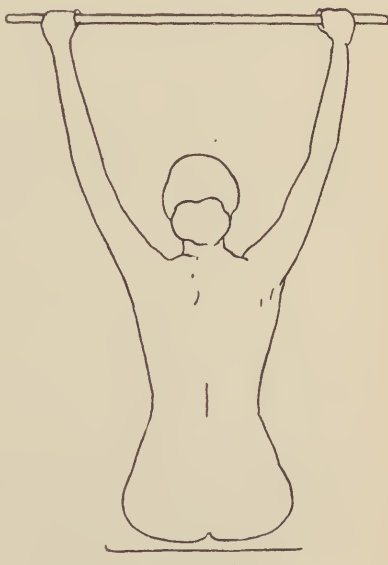


FIG. 42.—Intermediate position.

Position.—Sitting; feet on floor. Grasp iron bar (2 pounds or more), which is held behind the shoulders, at level of upper borders of scapulæ.

Movement.—1. Push bar slowly upward until arms are fully extended.

2. Pull bar downward slowly and forcefully, contracting the muscles of the back strongly. (For strengthening rhomboids.)

EXERCISES FOR STRENGTHENING MUSCLES IN THE CORRECTED POSITION.

12. Assume the best posture possible, and hold, during the exercise.

Position.—Standing, arms at sides of body. Hold dumb-bells (2 pounds).

Movement.—Raise arms slowly sideways to horizontal. Return slowly to first position. Repeat as long as it is possible to hold the correct posture (Fig. 43).

13. "Correction" at the mirror. (For training new coördinations.)

(a) *Position*.—Stand in front of mirror. Assume the correct position. Relax. Assume position and relax frequently.

(b) Assume correct position. Walk around the room and endeavor to hold good position. Return to mirror and observe.

14. Slow arm extension (Fig. 44).

Position.—Stand in correct position. Elbows bent. Hands at shoulders.

Movement.—Extend arms slowly sideways, extending fingers and reaching as far as possible without lift-

ing the shoulders or tensing the neck, retracting the scapulæ by strong contraction of rhomboids.

15. Trunk bending forward (Fig. 45).

Position.—Stand in correct position. Hands on hips or at neck.

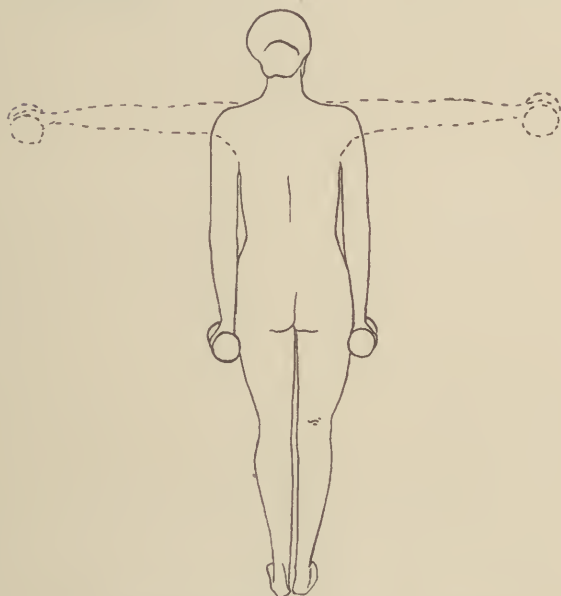


FIG. 43.—Arm raising sideways with dumb-bells.

Movement.—Bend forward from the hips, keeping the back flat. Return to erect position 10 times. (Strong back exercise.)

16. "Aëroplane exercise" (for general flexibility and for strengthening muscles of trunk and waist) (Fig. 46).

Position.—Stand erect with feet apart. Arms extended sideways.

Movement.—Twist trunk backward to left, trying to touch left toe with right hand by bending forward.

Keep knees extended and do not change the position of the arms. Return to erect position, twist trunk forward. Pause. Repeat, to opposite side, 5 times to each side.

17. "Bicycle exercise." (By permission of Mr. W. Curtis Adams, Pompton, N. J.) (Figs. 47 and 48.)

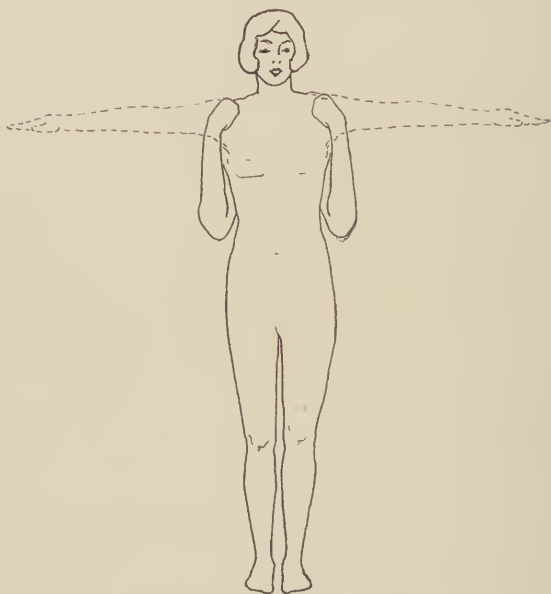


FIG. 44.—Slow-arm extension.

Position.—Lying on back, with buttocks against wall.

Hips flexed; knees extended; hands at shoulders.

Movement.—1. Drop one leg, flexing knee and hip, and extending ankle. Fling both arms upward, extending fingers.

2. Extend leg, sliding it up on the wall, pushing with heel until ankle is well flexed. Allow the other

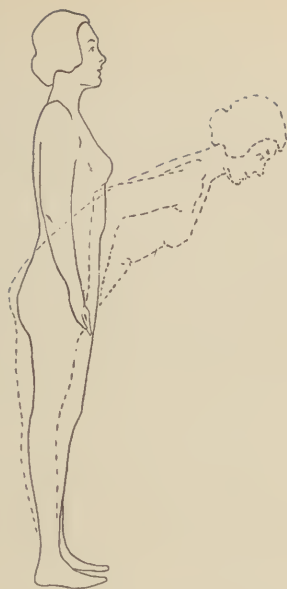


FIG. 45.—Trunk bending forward.

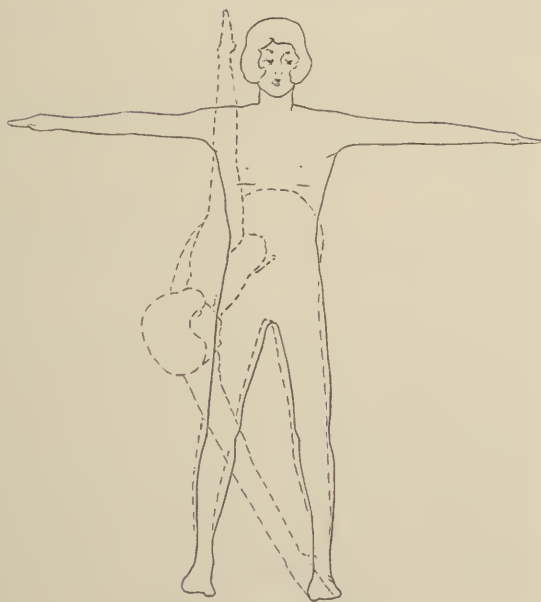


FIG. 46.—Aéroplane exercise.

leg to drop (as in 1). Bend elbows, bringing hands to shoulders. Repeat rhythmically. Number of times may be increased almost indefinitely, with short periods of rest interspersed. Object of exercise is general strengthening of back, chest and waist muscles. It corrects tendency to lordosis. Also stretches posterior musculature and tendo Achillis and gives excellent foot action.

18. Sitting; trunk twisting (strengthening abdominal and lower back muscles) (Figs. 49 and 50).

Position.—Sitting erect astride a stool or plinth. Hands on hips or neck; feet on floor.

Movement.—1. Twist trunk to side, keeping elbows in plane with the body.

2. Twist to opposite side. Repeat 8 to 10 times, each side.

19. Sitting; trunk bending sideways (strengthening waist and lower back) (Figs. 51 and 52).

Position.—Sitting as in Exercise 18.

Movement.—Bend trunk to side; raise to erect position. Bend to opposite side. Repeat 8 to 10 times each side.

20. "Stretching exercise" (for strengthening trunk muscles).

Position.—Lie on the back. Arms bent; hands behind neck.

Movement.—Extend one arm upward, and at the same time stretch across the body with leg on same side (Fig. 53).

21. For correcting lordosis.

Long sitting position. Pupil sits on floor, with legs extended forward, keeping the back erect. This position may be taken also, by having the back placed against the wall (easier in the beginning).



FIG. 47.—The Adams bicycle exercise; first movement.

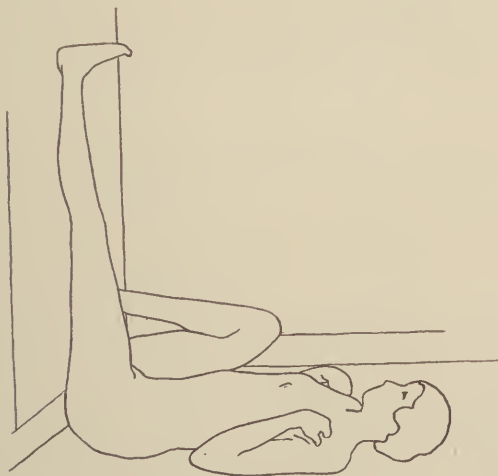


FIG. 48.—The Adams bicycle exercise; second movement.

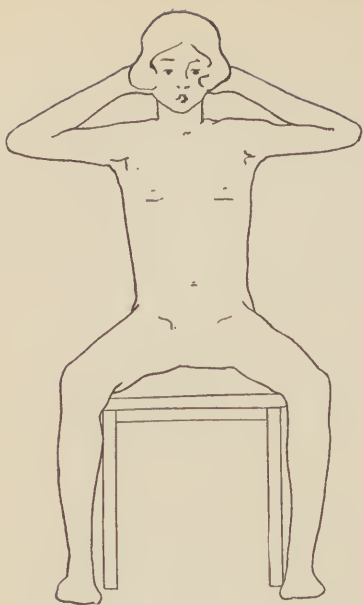


FIG. 49.—Position.

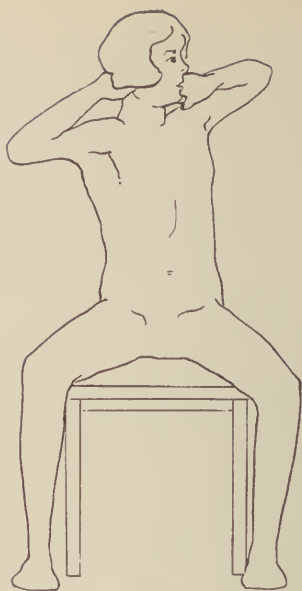


FIG. 50.—Movement.

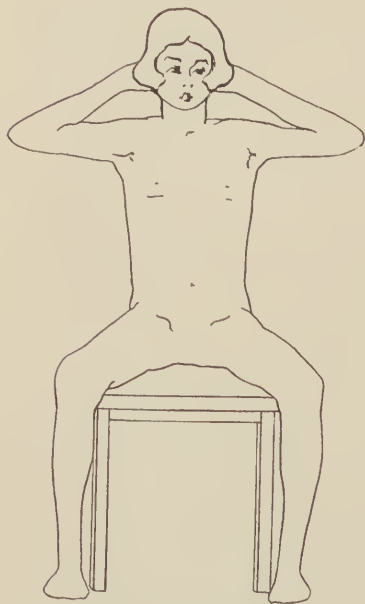


FIG. 51.—Position.

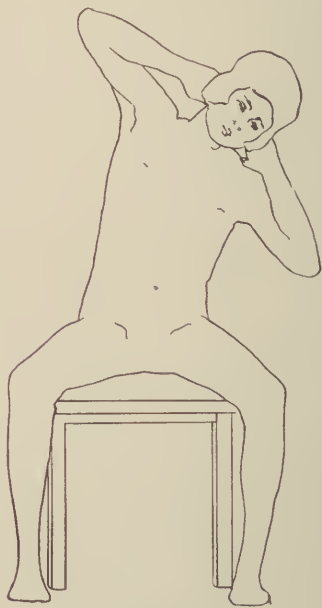


FIG. 52.—Movement.

If a pupil has a marked lordosis, or is unable to perform an exercise without hollowing the back, this tendency may

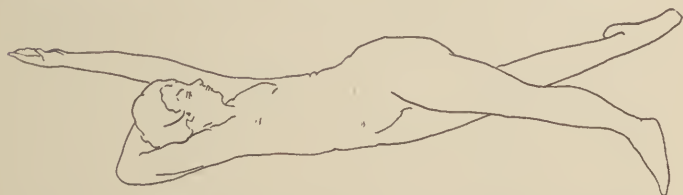


FIG. 53.—An exercise for strengthening trunk muscles (Exercise 20).



FIG. 54.—Lordosis not sufficiently corrected by the sitting position.

be lessened by having the exercise performed in the sitting position and the tendency entirely eliminated by assuming the “long sitting position” (Figs. 54 and 55).

22. "Half somersault." For correcting lordosis.

Position.—Lie on the back. Arms at sides; knees bent; feet on floor.



FIG. 55.—Lordosis in Fig. 54 eliminated by long sitting position.



FIG. 56.—An exercise for the correction of lordosis.

Movement.—Draw knees upward to chest. Extend knees, swinging legs over head and raising pelvis

from floor (Fig. 56). Return to position by flexing the knees.

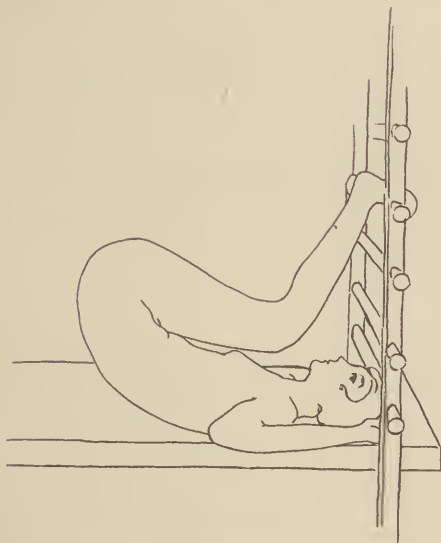


FIG. 57.—Reversed ladder-climbing for correction of lordosis.



FIG. 58.—May be adapted to strength as follows: 1-2-1; 1-2 3-2-1; 1-2-3-1; 1-3-1.

23. Reversed ladder-climbing (for lordosis).

Position.—Lie on back. Grasp stall bars.

Movement.—Throw legs over head. Grasping stall bar with toes. Climb upward as far as possible and downward, returning to first position again (Fig. 57).



FIG. 59.—Head bending backward.



FIG. 60.—Arm flinging sideways.

24. Lying; knee bending (abdominal exercise).

Position.—Lying on back; arms at sides of body; legs extended.

Movement.—1. Flex knees and hips.

2. Extend knees.

3. Lower extended legs slowly to floor. Repeat only 4 or 5 times in the beginning.

NOTE.—This exercise may be made easier by simply drawing the knees to chest and replacing to floor, without extension upward. It may be made more vigorous by raising both legs, extended, to perpendicular and returning in same way to first position (Fig. 58).

25. Standing. Head bending backward (for improving position of head and strengthening muscles in cervical region) (Fig. 59).



FIG. 61.—A good general exercise. Position of knees prevents lordosis.

Position.—Stand erect. Hands on hips.

Movement.—Draw head horizontally backward without lifting the shoulders.

26. Standing; arm flinging sideways (for improvement of posture in upper dorsal and cervical regions) (Fig. 60).

Position.—Stand erect. Arms bent at shoulder level and elbows drawn well backward.

Movement.—Fling arms forcibly sideways, drawing head back at the same time.

27. Spine-stretching.

Position.—Sitting, hands placed lightly on top of head.

Exercise. Stretch up with head, extending spine without lifting the shoulder girdle.

28. Hand stand at stall bars. An exercise of this type is valuable in many programs. The position is that of inverted hanging, head down, body extended upward, with back against the stall bars. This position reverses and stimulates the circulation, also corrects a tendency to ptosis by allowing the organs to be thrown upward into the body cavities.

29. Heel-raising. Knee-bending, with knees together. A good general exercise (Fig. 61).

EXERCISES FOR POISE AND BALANCE.

1. Slow toe march. Walk on toes. Feet straight.

2. Walk in good posture, carrying weight on head.

3. Poising exercise. Stand on one foot, heel raised, bend other knee upward at right angles. Raise one arm upward extending other arm downward. To be done with extreme freedom.

4. Progressive walking exercise.

(a) 1. Step forward on one foot.

2. Lift backward heel, transferring weight to forward foot.

3. Replace backward heel. Repeat several times. Same with other foot forward.

(b) Repeat 1 and 2 as in Exercise 4. Then swing backward leg forward and take a step, pro-

gressing into a slow walk, which may be accelerated gradually (Fig. 28).

SITTING POSTURE.

More emphasis should be laid upon the importance of the correct sitting posture and definite instruction be given in regard to this. It would be wise to embody the sitting position in the form of an exercise in every program. This exercise could be done to advantage with a group as follows:

March class to stall bars. Stall bar benches down. About face.

SIT.

1. Draw one foot to rear.
2. Transfer weight to backward leg.
3. Bend knees.
4. Lower body slowly to sitting position.

STAND.

1. One foot to rear.
2. Bend forward from hips.
3. Push with backward leg.
4. Lift body to erect position, transferring weight to forward leg.

TYPICAL PROGRAMS OF EXERCISES.

I. STIFF ROUND BACK.

Type.—Flat chest; contracted pectorals; flexed knees; pelvic angle decreased; weight over heels; abdomen relaxed.

Indications for Exercise.—Stretch chest muscles; strengthen rhomboids; strengthen abdominal muscles; posture training.

EXERCISES.

1. Relaxation exercises.
2. General flexibility—Aéroplane (No. 16).
3. Posture training.
4. Swing on rings.
5. Passive chest-lifting (No. 1).
6. Bicycle (No. 17).
7. Mat. Flexions (No. 10).
8. Pelvic control exercises.
9. Walking and sitting exercises in correct posture.
10. Posture training at mirror.
11. Hook-lying ninth-rib breathing. Hands placed lightly on lower ribs.
12. Rest relaxed on mat.

II. FLEXIBLE ROUND BACK.

Type.—Floppy; scapulæ prominent; knees hyperextended; relaxed rhomboids; pelvic inclination decreased.

Indications for Treatment.—Coördination; strengthening muscles; pelvic control; much stress on posture; exercises for flexibility not necessary.

EXERCISES.

1. "Jumping-jack" (Fig. 24).
2. Relaxation exercises.
3. Posture training.
4. Active hanging.
5. Pelvic control exercises.

6. Sitting (stretch). Pull iron bar slowly downward (Fig. 41).
7. "Bicycle."
8. Self-correction at mirror.
9. Practice walking and sitting.
10. Aëroplane exercise.
11. Hook lying. Deep breathing.
12. Rest, relaxed, on mat.

III. STIFF ROUND HOLLOW BACK.

Type.—Shoulders round; head forward; abdomen prominent; lower back weak and hollow.

Indications.—Increase flexibility of upper back; strengthen lower back and abdomen; care taken not to increase lordosis.

EXERCISES.

1. Jumping-jack (Fig. 24).
2. Relaxation exercises.
3. Posture training.
4. Low hanging at stall bars. Legs extended forward.
5. Lying on back. Knee-bending. (Abdominal, Fig. 58.)
6. Stride sitting. Trunk-twisting and trunk-bending. (Exercise 18 and 19.)
7. Bend hook lying. Arm extension with dumb-bells (Fig. 31).
8. Long sitting (at wall). Pull arms slowly downward (rhomboids).
9. Standing at wall. Pelvic control exercises.
10. "Bicycle."
11. Practice correct posture. Walking and sitting.
12. Relaxation and rest.

IV. LORDOSIS.

Type.—Position of upper back fairly good; extreme hollow in lower back; pelvic angle increased; knees hyperextended.

Indications.—Strengthen lower back; attention to position of knees; concentrate on position of pelvis.

EXERCISES.

1. Forward bending of trunk; relaxed.
2. Standing. Heel-raising and knee-bending; knees straight (Fig. 61).
3. Plinth. Stride sitting; trunk bending forward; back flat.
4. Mat. Knee-bending upward (half somersault) (Fig. 56) or reverse ladder-climbing.
5. Bicycle.
6. Sitting. Swing bar over head (Fig. 38).
7. Pelvic control. Wall.
8. Posture training.
9. Walking in good posture.
10. "The Mosher" exercise.
11. Rest; relaxed on mat.

CHAPTER VIII.

CORRECTIVE EXERCISES FOR GROUPS.

IN a book devoted to the subject of individual gymnastics, where stress is laid upon the necessity for individual attention in the application of exercises, it would seem almost contradictory to find a chapter given to the subject of corrective exercises for large groups.

The need for some work of this nature is being felt increasingly by teachers of physical education in schools, especially the public high schools, where large groups of students must be handled.

It is apparent that the present program of physical education in the schools must be reconstructed, or else supplemented by special exercises for the correction of faulty postures, so that correct posture may become the rule rather than the exception.

In schools where classes are large, ranging perhaps from fifty to one hundred, where time is limited and the program of the teacher is already overfull, individual lessons are not possible except in rare instances. What, then, may be accomplished with a large group? Is it possible to plan work of such character as may meet at least some of the individual needs? To this end plans are being tried out, in most instances with considerable success. "Mass correctives;" "group correctives;" "posture group work" are some of the terms applied.

How can classes of this character be organized in order that the greatest benefit may accrue to the individual, and what type of exercises shall be chosen? It seems

possible that programs can be planned such as will be of much value, and that interest can be stimulated in the student which may establish a desirable posture consciousness.

Several plans for the organization of such classes are subjoined with exercises indicated.

IN GENERAL.—A physical examination of each student is presupposed. Pupils having scoliosis are advised to have treatment by a specialist. The teacher, if time permits, may organize small groups for individual work for the correction of scoliosis and other specific conditions at other than class periods. These pupils should also join the "group posture class."

Group posture work may be made either a part of each program in the gymnasium, or certain entire periods may be devoted to it, the exercises distributed through the program of which they constitute the major part.

PLAN I.

1. Class organized into squads according to type of posture and exercises necessary.

2. Each squad led by a captain chosen by instructor. (This could be made a merit for good posture, and thus act as an incentive. The captains could be changed monthly, and some insignia given the retiring captain to be held as long as her good posture continued.)

3. Captains attend regular meetings, where exercises are taught by instructor.

4. Posture grades can be given individuals and also to squads. By posting these, lively interest through competition can be aroused. Short reports and talks could be given at assembly monthly.

5. In the gymnasium.

(a) Mass work.

(b) Squad work.

Division of program.

Marching, 5 minutes.

Squad exercises, 15 minutes.

Mass work with instructor, 10 minutes.

Dancing or games, 10 minutes.

Period, 40 minutes.

PLAN II.

Squads and squad leaders as before, but in this case the squad leaders are assigned to the supervision of apparatus or certain exercises. The students pass from one exercise to another in routine.

Example, supervision of:

(a) Hanging from horizontal bar.

(b) Bicycle exercise.

(c) Scissors exercise.

(d) Passive chest lifting.

(e) Foot exercises.

Division of program as in Plan I.

Squads can be organized for special exercises not alone for the correction of posture but for other purposes as well, viz.:

Squad 1. Posture correction.

Squad 2. Overweight. (A diet list should be given these students and chart posted recording weight.)

Squad 3. Constipation.

PLAN III.

One period once a week or during each regular period; students assist one another in many of the exercises.

The following are some of the exercises which may be done in couples, and worked in as part of the regular program.

Students arranged in files so that each is standing beside a partner.

1. Trunk freeing exercise (p. 101, Exercise 1) alone.
2. Arm pendulum exercise (p. 102, Exercise 2) alone.
3. Leg pendulum exercise (p. 102, Exercise 3).
 - (a) Arms extended sideways; hands on partner's shoulder.
 - (b) Swing outer legs.
 - (c) About face and repeat.
4. Posture correction in files.
 - (a) March; halt in files.
 - (b) Alternate files face so that partner is observed in profile.
 - (c) Correct the posture of partner.
 - (d) About face.
 - (e) Correct posture.
5. Passive chest-lifting.
 - (a) Number 1 sits on floor, either "long sitting" or tailor fashion.
 - (b) Number 2 takes good fallout position behind.
 - (c) Passive chest-lifting (Fig. 29).
 - (d) Change partners.
6. (a) Sitting tailor fashion on floor; back to back; arms extended upward grasping partner's hands.
 - (b) Flex elbows, drawing arms slowly to sides, with resistance (for strengthening rhomboids).
7. (a) Position sitting as in Exercise 6; partners facing one another.
 - (b) Arms extended forward, grasping partner's hands.

- (c) Number 1 bends elbows; drawing arms horizontally backward; inclining trunk slightly backward at same time. Number 2 offers slight resistance.

(d) Alternate.

Exercises of this character may be distributed through the teachers "mass-corrective" program and tend to make interest more keen.

TYPICAL PROGRAMS OF EXERCISES FOR GROUPS.

I.

1. Habit-freeing exercises.

Arm pendulum.

Leg pendulum.

Spine "folding and unfolding."

2. Training for "Poise."

(a) Balance body with legs, trunk and head in alignment.

(b) Raise slowly on toes. Down softly on heels. Repeat more quickly, keeping poise.

NOTE.—1 and 2 may be performed with music.

3. "Grip walk" exercise. (See p. 221, Exercise 7.)

4. Posture training in couples.

5. Prone bend standing position; slow arm extension sideways.

6. Marching to stall bars; "correct sitting" exercise.

7. Long sitting on floor; arm-flexion and extension with partners.

8. Standing. "Aëroplane" exercise.

9. Standing. Heel-raising; knee-bending, with knees together.

10. Slow walking for inspection.

NOTE.—Exercise 10. At the end of each period the class marches slowly, single file, around the gymnasium. Teacher observes students in profile; quickly notes and comments on posture of each, thus: “head up”; “good posture”; “too stiff”; “hollow back,” etc.

II.

- 1 and 2 as in previous program.
3. Run in place.
4. Posture correction in couples.
5. Sitting. Passive chest-lifting (in couples).
6. Slow walking and sitting exercises.
7. Standing. Foot-gripping exercise.
8. Active hanging on stall bars or boom.
9. Sitting on floor. Hands on head. Spine-stretching.
10. Sitting. Hands on lower ribs; “ninth-rib breathing.”
11. Walking for inspection.

SUMMARY.—The majority of the exercises given in the preceding chapters may be used, with slight adaptations, in group work. *Recreational values* must not be overlooked if the best results are to be obtained.

In the opinion of the author, the content of a lesson not alone for “group correctives” but of any gymnastic lesson might be formulated thus:

1. Body-freeing exercises.
2. Specific posture exercises and posture training.
3. Games and dances.

CHAPTER IX.

VISCEROPTOSIS.

“PTOSIS” is the term used to indicate a drooping or falling of any part of the body. The most frequent application of the term is to the abdomen and to the viscera. Thus “abdominal ptosis” and “visceroptosis” imply the relaxation of the muscles constituting the abdominal walls and the displacement downward and forward of the viscera. The “dropped stomach” of which one hears in common parlance is one form of visceroptosis. This condition is one of the most pernicious of the accompaniments of poor posture, and the cause of so many physical and mental ills that it well merits the attention which is directed to it. There is a type of congenital ptosis, but in the majority of cases it is acquired.

As has been shown in the chapter on Posture, all the segments of the body should be in such relation to one another and to the center of gravity that they form a completely adjusted mechanism for the performance of efficient work, and in this state the organs thus coördinated are in the most advantageous position for healthful functioning. The importance of the strength of the abdominal muscles, in preserving this relationship and in the support of these organs, cannot be overestimated, yet these are the groups most frequently weak, especially in women.

ETIOLOGY.

The stress of the upright position, the constant downward pull of gravity, the prevalence of sedentary occupations, all

tend to ptosis. The distention of the abdomen, the after-effect of relaxed muscles, and all that child-bearing entails, is also another potent factor with many women. In many instances individual psychology may be basic. Mental and physical relaxation are closely allied. The person with an inferiority complex depresses head and chest and assumes a position showing little or no muscular control. The resultant condition is a sagging along the lines of least resistance, a true ptosis of the whole mechanism.

The abdominal viscera, stomach, liver, pancreas, spleen, kidneys and intestines are held in position by ligamentous folds of peritoneum, binding them to the posterior walls of the abdomen. Their contiguous surfaces are so molded that they fit around one another to a nicety, without undue pressure. The forward slant of the dorso-lumbar spine, and the posterior abdominal muscles afford points of support as well.

In the well-poised body, the pelvic cavity is posterior to the abdominal, and the weight of the abdominal organs is borne by the abdominal muscles and does not fall upon the pelvic organs.

Between the abdominal and thoracic cavities, is spread the diaphragm. When this great muscle and those of the anterior and posterior walls, and the floor of the cavity are kept in good tone, a strong pressure is exerted upon the organs, which is known as the *intra-abdominal pressure*, and helps still further to hold them in place.

In the condition of visceroptosis, the abdominal muscles relax, thus removing the anterior support, the intra-abdominal pressure is lessened, organs collapse, press downward upon one another, the weight is transmitted to the pelvic cavity and organs, ligaments become strained, the diaphragm does not work as freely, the chest becomes depressed and the

heart and lungs are no longer in the best position for functioning. In addition, there may be undue pressure upon nerves and bloodvessels. There is frequently pain in the back and a feeling of chronic fatigue. It is only reasonable to conclude that there is almost no limit to the disturbances of function of the organs, and of the nerves, which may be traced to this source.

A knowledge of bodily mechanics is most important for the teacher of physical education as well as for the medical practitioner, so that when advice is sought for some local trouble, the body, as a whole, may be considered as possibly participating, and the maladjustments and results incident upon poor posture be taken into account. For example, in a condition of chronic indigestion, exercises for the correction of a ptosis—the mechanical readjustment of the body—which would result in improving the position and functioning of the stomach, would be of far more lasting value than the application of drugs which, at the best, are only palliative, and while temporarily alleviating uncomfortable symptoms, do not strike at or reach the root of the difficulty.

TREATMENT.

Consideration should be first given to contributory causes, such as a faulty arrangement of clothing, tight waistbands and heavy skirts, which tend to drag down on the abdomen, or a corset poorly adjusted, which makes a downward pressure on the organs.

The high-heeled shoe is distinctly evil in its influence, and low-heeled shoes should be advised in all cases. (This subject is discussed at length in the chapter on Shoes.)

A certain type of *corset* is frequently advised as an adjunct to the treatment by exercise for some of the cases of viscer-

ptosis. It should be low and not constrict the waist, but long below the waist, with a firm grip around the hips, and be adjusted in such a way that the abdomen is lifted, thus preventing the downward sag of the organs. This should be preferably a front-laced corset adjusted in the lying position.

One authority believes that in most of the severe cases there is a marked "run-down" condition—both physical and mental—attended by loss of weight, and that rest of half an hour or an hour after each meal, lying in a horizontal position on the back, should accompany the treatment. In this position the organs return to their normal adjustment and the strain on muscles and ligaments is relieved.¹ Mental stimulation along the line of encouraging self-confidence, and promoting interest in life would be necessary in many cases.

Attention cannot be called too often to the fact that general hygiene is always of prime importance.

Exercises.—Exercises should be of a similar type as those for improvement of posture, and for strengthening especially, the muscles of the lower back, abdomen and waist. (See Chapter VII.)

The bladder should be emptied before beginning any abdominal exercises.

1. *Knee-chest Position.*—Kneel on mat. Bend trunk forward from the hips, until chest and elbows rest on the mat, with arms forward bent, head resting on hands. This position should be taken once or twice a day, five minutes or more at a time. It allows the organs to fall back into normal position, relieves strain and improves abdominal circulation (Fig. 62). This position should be assumed in bed for five minutes after retiring, and the patient instructed

¹ Chase, R. F.: The Treatment of Visceroptosis, Boston Med. and Surg. Jour., August 30, 1917.

to lie down immediately afterward, without assuming the upright position again, thus encouraging the organs to remain in their corrected position overnight.

(a) Leg-raising backward from knee-chest position.

Position.—As in previous exercise.

Movement.—Raise one leg backward, taking one or two deep breaths at the same time. Replace leg; rest a moment and repeat with the other leg.

NOTE.—The action of the diaphragm in breathing facilitates the correct adjustment of the organs.



FIG. 62.—Knee-chest position.

2. *Reversed Breathing*.—Lie on mat, on the back, knees bent upward, feet on floor (the “hook-lying position”). Arms at sides of the body. (a) Inhale slowly; (b) bend one knee upward until it presses on the abdomen forcibly, and exhale; (c) replace foot on mat. Inhale. Repeat the movement, alternating knees.

3. *Trunk-circling*.—Stride sitting (preferably on the plinth), hands on the hips, bend trunk forward from the hips, swing sideways and circle backward, to first position. Same to the other side (Fig. 63).

4. *Trunk-twisting*.—Starting position the same as in the preceding exercise. Twist trunk as far as possible, first to

right, then to left. The strength of the exercise may be increased by placing the hands on the neck.

NOTE.—Exercises for posture, in the standing position, should be given. Voluntary contraction of the abdominal muscles practised while walking, holding good posture, is one of the best.

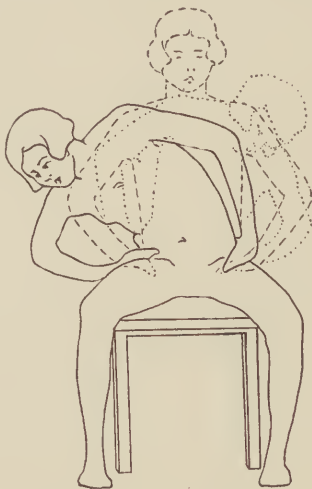


FIG. 63.—Trunk-circling.

The number of times each exercise shall be performed depends upon the judgment of the teacher as to the needs and ability of the individual.

Exercises described in Chapter VII (numbers 10, 12, 13, 14, 16, 17) will be found useful also.

CHAPTER X.

SCOLIOSIS.

SCOLIOSIS, or lateral curvature of the spine, is defined by Dr. Lovett as "a condition in which any series of vertebral spinous processes shows a constant deviation from the median line of the body, a deviation always accompanied by an element of twisting."

The word "scoliosis" is of Greek origin, meaning twisting or bending, and its application to this condition is of great antiquity, having been so used by Hippocrates, several hundred years B.C.

Referring again to the anatomy of the human frame and to a discussion in an earlier chapter of the necessity of keeping the parts of this segmented mechanism in proper relation to one another and to the center of gravity, it will be seen that influences tending to disturb the equilibrium may be such that lateral deviations of the spine may result as well as deviations in the antero-posterior plane. In such cases the degree of distortion is even greater than in antero-posterior deflections.

One need only visualize the flexible spine unstably balanced on the pelvis, and remember the close relation between the spine, ribs, sternum and shoulder girdle, to appreciate the asymmetrical adjustments which would result from any displacement of the spine laterally. Then it can be readily understood why lateral curvature of the spine is regarded as a serious condition and one peculiarly difficult of correction.

The deviations which occur in the framework of the body will produce certain changes in the outline of the figure, such as an asymmetry of the two halves of the body, alteration in the position of the shoulders and scapulæ, displacement of the trunk over the pelvis, and an apparent inequality of the hips. These and other slight abnormal variations of the body symmetry are usually the first things noticed and are regarded by the observer as original conditions rather than the results of underlying causes. It is often hard to convince a person that the prominent hip or high shoulder, for which advice has been sought, is of spinal origin.

Lateral curvature is not usually accompanied by pain. This would occur only in severe cases where the deformity is so extreme as to cause pressure on the nerves, or to occasion ligamentous and muscular strain.

Curves are named according to the regions of the spine in which their convexities occur, cervical, dorsal or lumbar. If involving parts of two regions, cervicodorsal, dorsolumbar. They are called right or left, corresponding to the direction of their convexities, and if more than one exists, the upper one is mentioned first: for example—"right dorsal, left lumbar curve."

CLASSIFICATION OF TYPES OF SCOLIOSIS.

I. Postural, functional or total.

II. Structural, or organic.

Postural Scoliosis.—The terms postural, functional or total curve are synonymous and constitute the simplest form of scoliosis. Some authorities contend that this is not a true scoliosis, that it is merely a fault of posture which has become habitual and should be classed with faulty postures or be called a false scoliosis.

The postural curve is called "total," as it is the deviation of the spine in its total length, to one side of the median line or the other, in the majority of cases, being to the left. There is no compensatory curve observable, and the untrained eye might not detect the deviation and consider the back normal. In this type, the spine can be straightened by suspension,



FIG. 64.—Typical postural scoliosis. Left total.

or by lying prone in a horizontal position, and the individual is frequently able to correct voluntarily, after being shown how to make the proper readjustments. The characteristic conditions accompanying this deviation of the spine to the side are as follows:

1. Displacement of the trunk over the pelvis toward the side of the convexity.

2. The shoulder and scapula on the side of the convexity, probably high.

3. Thorax and shoulder girdle on the concave side twisted backward, making the corresponding scapula prominent.

4. The angle made by the arm with the waist (called the "arm-waist angle") is less on the convex and greater on the concave side.

5. Hip on the concave side is prominent.

Structural Scoliosis.—This is a more serious condition, for structural changes have actually taken place in the bones and tissues. It has been found that under pressure, bones adapt themselves to altered positions through changes which take place in the bone substance itself, hence the gravity of the condition, and the almost unsurmountable difficulty to be faced in correction.

Adaptive changes also occur in the muscles and ligaments, and the curve cannot be straightened voluntarily nor be entirely corrected in the hanging or the "prone-lying position," as was possible in the case of the postural curve. There are varying degrees of severity, from the slight flexible curve, with little alteration of body symmetry, through a diversity of stages, to the fixed structural scoliosis, with marked changes of contour and extreme deformity. In the advanced stages complete correction should not be expected.

Structural curves are of two types:

A. The *simple structural* involving one region of the spine only, and with no compensatory curve: usually dorsal or lumbar. This type should be in no way confused with the "total" curve, previously described, which is always postural and involves the entire spine.

B. The *compound structural* curve is the form more frequently seen. It involves two or more regions of the spine, and is usually double, though it may become triple, one

curve compensating another in the effort to preserve the equilibrium.

It is difficult to give a typical picture of the adjustments which will be found accompanying a structural scoliosis. No two individuals are exactly alike. The type and stage of development of the curvature, as well as the type and



FIG. 65.—Typical compound structural scoliosis (right dorsal, left lumbar).

flexibility of the individual, combine to produce ever-varying and often most surprising results. In general, however, it will be noted:

1. The spine will be curved laterally in two or more regions.
2. There will be a prominence in the region of each convexity (due to "rotation").

3. Marked difference in the height of the shoulders—the one on the side of the dorsal convexity, probably high.

4. The scapulæ will be displaced both as to height and inequality of distance from the spine.

5. The arm-waist angle will be greatly increased on the side of the lumbar concavity and the hip on the same side will be markedly prominent (Fig. 65).

The structural scoliosis may, and frequently does develop from the postural curve. For this reason, the postural curve should be watched with apprehension, for after it has increased to a certain point, the disturbance of balance is such that an effort is evidently made by the organism to preserve the equilibrium. An attempt is made to square the shoulder girdle keeping it in line with the pelvis, and to maintain the position of the head in the median line of the body; the spine yields at some point, a compensatory curve results, and the beginning of a compound structural lateral curvature is established.

Two important factors to be considered in every case of structural scoliosis are the *lateral deviation*, and the *rotation* of the spine. These always occur simultaneously although they may vary in degree.

Lateral deviation of the spine differs from lateral bending in that it is the bending of the spine on itself, with the head held in the median line.

Rotation is the turning on a vertical axis of all the vertebræ affected by the curve, the amount for each vertebra differing, the maximum being at the greatest convexity of the curve. The explanation of rotation is that the bodies of the vertebræ support most of the weight of the trunk, and when the spine begins to bend laterally, compression on the concave side results, the bodies turn away from the line of weight, the ligamentous attachments of the spinous and transverse proc-

esses are stronger than those of the bodies and tend to hold them in position, so the bodies turn in the line of least resistance, which is *always* in the direction of the convexity of the curve.

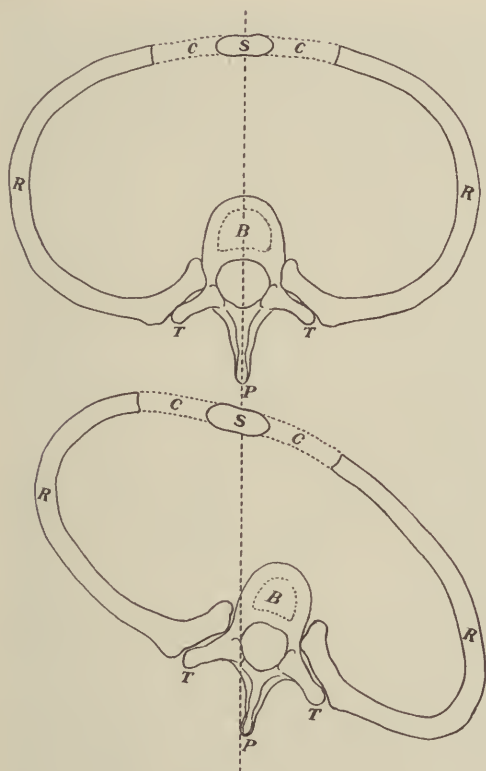


FIG. 66.—Diagrammatic representation in horizontal plane of "rotation," showing displacement of vertebra by combined lateral deviation and rotation. *B*, body of vertebra; *T*, transverse process; *P*, spinous process; *R*, ribs; *S*, sternum; *C*, cartilages.

As the ribs are attached to the bodies and transverse processes of the vertebræ, any alteration in the position of the

latter, especially such as that produced by rotation, will result in a marked change in the position of the ribs and consequently in the contour of the thorax, which will be fuller posteriorly on the side of the convexity and depressed on the concave side (Fig. 66). As may be seen from this diagram the rotation "compensates" or makes less apparent, the lateral deviation, and that for this reason the distortion of the trunk frequently may appear greater than the line of deviation of the spinous processes would seem to warrant. If rotation is present as the accompaniment of a curve in the lumbar region, there will be a fulness on the convex side occasioned by the erector spinæ muscle which, overlying the lumbar vertebrae, is consequently thrown into prominence.

Kyphoscoliosis.—In connection with a structural scoliosis, a marked kyphosis is sometimes associated. The combination of these conditions results in considerable deformity.

It is given the name of kyphoscoliosis.

PATHOLOGY.

Scoliosis is not a disease of the spine, but the result of faulty growth. The condition is not regarded as pathological until it becomes structural. In a functional curve, as the name implies, the difficulty is functional and no structural changes have taken place. In a structural scoliosis the alterations which occur in the bones and soft tissues vary from a slight degree, to those extreme conditions which produce gross deformity.

The *intervertebral disks* are among the first structures to show adaptive changes. They become wedge-shaped: thin on the concave side of the curve and thick on the convex.

The *vertebrae* also assume a wedge-shaped appearance,

thinner on the concave side and thicker on the side of the convexity. In severe cases the bony substance becomes twisted as well.

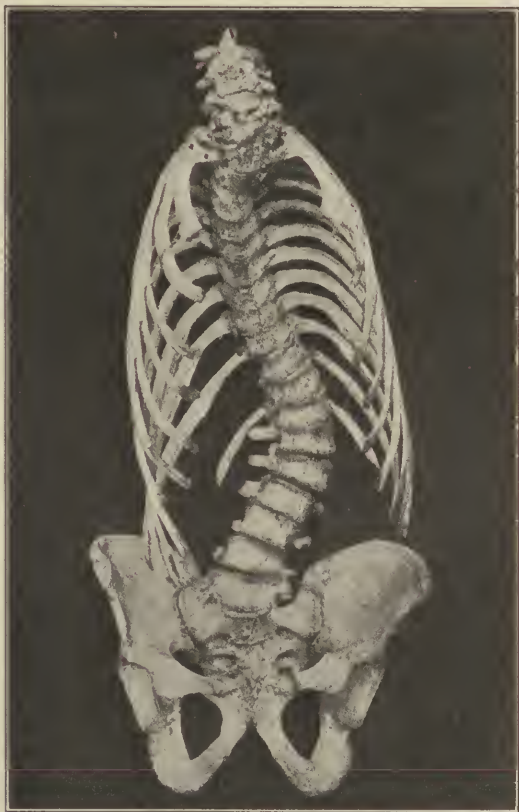


FIG. 67.—Scoliotic spine from the Dwight collection of abnormal spines in the Warren Museum.

The *ribs* bulge and increase in angularity on the convex side because of “rotation,” while on the concave side they tend to spread out toward the sternal end. This alters the

entire shape of the *thorax*. The sternum remaining a fairly fixed point, the result is a prominence of the chest in front diagonally opposite to the rotation posteriorly, and a corresponding depression of the chest and back on the opposite sides (Figs. 66 and 67).

The *scapulae* become altered in position, and sometimes in shape as well. In extreme conditions even the bony pelvis is distorted.

It follows necessarily that the organs enclosed in the thoracic, abdominal and pelvic cavities will accommodate themselves to the altered conditions. When displaced to a considerable degree their functions may be more or less interfered with. The heart and lungs are earliest to suffer, and it is usual to find poor respiration accompanying a scoliotic condition. The heart is not only crowded out of place, but is also directly affected by the insufficient breathing and a lowering of the general vitality is probable.

The *ligaments* make adaptive changes, either becoming thicker and shorter, or thinner and longer. This results in unequal flexibility.

The *muscles* are thrown out of their normal positions and their action altered. They may also suffer from fatty or fibrous degeneration.

SUMMARY.—Structural scoliosis is of diverse types, confined to one region of the spine with a small or great amount of rotation, or may involve two or three regions. From statistics gathered in the observations of patients during several years at the Children's Hospital, Boston, the frequency of the occurrence of the several types was as follows:

Single structural were not as common as compound structural; of these, the dorsal type was most frequent, and the single lumbar less so. Of the compound structural, the right dorsal-left lumbar occurred more often than the left

dorsal-right lumbar and of the triple curves, the left cervical-right dorsal-left lumbar was more often seen. Of the total or postural curves the majority were to the left.

ETIOLOGY.

As we have already demonstrated, scoliosis is a lateral deviation of the spine from the median line, resulting in readjustments of the two lateral halves of the trunk so as to destroy their symmetry. As in our study of the etiology of faulty antero-posterior postures, in order to arrive at any sort of conclusion regarding the factors causing such a condition as scoliosis, it is necessary to pursue much the same lines of investigation. All those elements in the environment of the individual which might exert an influence upon symmetrical growth should be reviewed, and also the general condition of the organism which would cause it to succumb to or resist such influences must have careful consideration.

A primary factor in all cases is the frequent assumption of one-sided positions that are persisted in until habits are formed and permanent adjustments take place. These abnormal attitudes may be traced to various causes.

Physical Defects.—It is very generally recognized that a large group of malpositions result from some underlying structural or physical defects that are often of congenital origin. For instance, a child may be born with a deficient or an accessory rib, with an elevated scapula or a deformed vertebra. These and other abnormalities would produce an asymmetry in the bony framework which in all probability would not be manifested until the upright position in walking was assumed, when the superincumbent weight exerting its influence and bearing unevenly upon the sup-

porting structures would induce constant faulty positions. It was thought formerly that these congenital defects were rare, but since there has been a more general use of the roentgen ray, surgeons are finding them so frequently that they conclude that many cases of structural scoliosis may be traced to them, and are using the roentgen ray as part of the routine examination.

There are other physical defects—not of congenital origin—which may also be the underlying causes of positions of asymmetry such as the loss of an arm or leg, or a short leg necessitating the one-sided use of the body. Any static interference with the balance of the body, which tends to alter the position of the spine in its effort to preserve the equilibrium, may thus produce lateral deviation and form the basis of a scoliosis.

Undoubtedly the mechanical distortion of the body frequently has its origin in some underlying physical defect in the bony framework. The same governing principle applies to the influence which may be exerted by other physical defects, though each of them may act in a different way. While there are a large number of such conditions, we will, however, briefly mention only a few. These are: Empyema, causing a contraction of the thorax on one side; serious burns or injuries resulting in scars which contract the tissues. Chronic appendicitis causing the assumption of a one-sided position to relieve the pain may be mentioned. Organic heart disease would likewise cause similar adjustments. Again, defects of hearing and vision also cause the frequent assumption of one-sided positions. Among the predisposing causes there is none that may exert a greater influence than infantile paralysis, which results in loss of muscle power with the consequent lack of support and alteration of the mechanics of the body.

An interesting and reasonable theory has been advanced recently to account for some of the extreme cases of scoliosis, for which no sufficient cause has heretofore been found, nor any satisfactory treatment suggested. This theory is that some of the intrinsic muscles, important in holding the spine erect, have been paralyzed. These inert, useless muscles are the oblique extensors and allied groups which form a network of muscular fibers connecting the ribs and vertebræ posteriorly, and it logically follows that no amount of training of the large body muscles would avail to stabilize the spine under such circumstances.

Many lateral curvatures of the spine have *no apparent underlying physical or structural defects* acting as causes. They must be sought in the surroundings and habitual acts of the individual. These are so numerous and of such varied character that it would be difficult to enumerate and classify them. For the sake of convenience, however, they may be included under the term "environment."

In addition to the consideration of the factor of frequently assumed faulty positions, attention must be also directed to the condition of the bony structure, the muscle tone and the influence exerted by the superincumbent weight.

School Environment.—Having discussed at length the problem of the growing child and the bearing of school life on posture, it may be sufficient to call attention here to the fact that all the conditions pertaining to fatigue, overexertion, nervous tension, and so on, will exert the same pernicious influences upon the formation of a one-sided posture. In fact, many curves of the postural type are probably started because of these conditions.

One writer has referred to school rooms as "the factories of scoliosis." Perhaps this statement is a little strong, nevertheless it serves to draw attention to the fact that this is a

subject for serious consideration. When seated for lengthy periods, and often at desks not at the proper height, attitudes commonly assumed are twisted positions, leaning forward with one elbow resting on the desk, or sitting on one foot. Some interesting studies made in regard to this showed the following results:¹

In all grades, only one-third as many girls as boys slide down in seats.

Leaning on one elbow begins in lowest grammar and increases in higher grades. Twice as frequent with girls as boys.

Sitting on one foot more common with girls.

The complexity of postures increases from lower to higher grades.

A favorite attitude in high grammar grades consists in crossing the right leg over left, bracing the leg in desk irons at left and leaning on left elbow.

1484 pupils observed:

Correct position, 13 per cent;

Stooped forward, 40 per cent;

Sliding down in seats, 13 per cent;

Twisted, 23 per cent;

Unclassified poor postures, 11 per cent.

As these observations were made some years ago, it is to be hoped that conditions have been bettered, by improved seating and attention to other phases of the problem, so that a higher norm of good posture would be found. However, we can be certain that much still remains to be accomplished in the school room.

For the purpose of particularly applying here what has been said elsewhere, and at the risk of reiteration, it may be

¹ Observations made by Miss Lillian Towne, Boston.



FIG. 68.—This habit was persisted in for several years.



FIG. 69.—Resultant: left total scoliosis with prominent right hip.

stated again in substance that *carrying books to and from school* is probably more pernicious in the formation of



FIG. 70.—Carrying school books in bag suspended in this manner tends to produce left total scoliosis.

lateral, than of antero-posterior faulty postures. The most common way for girls to carry their books is to rest them upon one hip, and always the same hip, until sometimes a regular shelf is formed, and the spine is pushed to the



FIG. 71.—Characteristic attitude, "standing on one foot."

opposite side. Many children use a bag attached to a long strap which passes diagonally across the body from one shoulder to the opposite hip, creating a one-sided pull upon the trunk and spine. It is also injurious to carry a

bag constantly in the same hand, and to allow it to drag down on the shoulder. The solution, as before mentioned, is to have two sets of books so that none need be carried, or to insist on having the books carried in such a way that the weight may be borne symmetrically (Figs. 68, 69 and 70). In some schools pupils are directed to alternate the side on which books are carried from day to day.

The habit of standing on one foot, allowing the weight to sink down, and throwing out one hip, is quite universal, both with children and adults. It is usually the same foot, and in these conditions tending toward postural curvatures will correspond to the already established "line of least resistance" and adds its influence toward increasing an undesirable condition. A poor antero-posterior posture is usually associated with the postural scoliosis. Both conditions would be fostered, especially by the above-mentioned habit (Fig. 71). Flexibility under such stress becomes unequal, the spine bending much more easily to the concave side there will never be any inclination to bend to the opposite side. Ligaments and muscles quickly adjust, the muscle sense of the symmetrical position is lost and the child is well started with a postural lateral curvature of the spine.

Clothing.—Attention has already been directed to the influence which uncomfortable or improperly adjusted clothing may exert in the production of errors of posture. The underwaists worn by many children with their pernicious puff on the shoulders, and improper shoes, causing a tendency to stand on one foot and relieve discomfort, may be mentioned. Tight belts are harmful when there is a lateral curve in the lumbar region, which gives a deepened waist on the concave side. The belt will press in, still further increasing the hollow, while on the convex side there

is firm resistance, which becomes a point of leverage from which the pull on the less resistant side will be made (Fig. 72).

Habits of Occupation and Recreation.—The school problem must be dealt with more universally than any of the habits of occupation, as it enters into the life of every child. Some of the evils of child labor are the vicious environment to which the child is subjected during the period of growth;

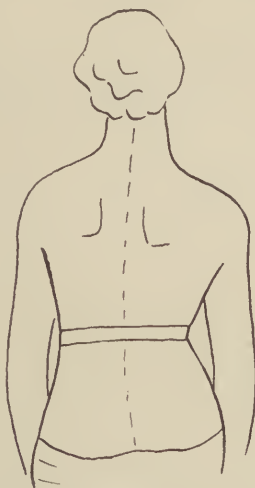


FIG. 72.—Showing the effect of a belt on a slight curve.

the confinement for many hours a day in unhygienic surroundings, seated many times in twisted attitudes; the use of foot power, almost always on only one side; or standing, as in factories, using one arm to perform the same recurring task. The newsboy, carrying a large bundle of papers always in the same way, day after day, often develops a serious scoliosis. The “little mothers” of the tenements, carrying younger brothers or sisters, propped usually on one hip, and

bearing a weight far beyond their strength, furnish another example. An interesting illustration is found among the Venetian gondoliers, who themselves recognize that they are one-sided. Holding the sweep with the left hand higher than the right, right leg extended backward and trunk bent forward while the arms swing downward, the constantly recurring position results in a left dorsal-right lumbar curve, and has been called "the gondolier scoliosis."

A similar condition might be produced by constant paddling in a canoe, and there are certain sports which should be prohibited or modified for an individual with a lateral curvature. For example, paddling with left hand high and a sweep to the right accentuates a left total curve. The reverse position would act as a corrective. A lad with a right dorsal-left lumbar scoliosis with marked dorsal rotation was observed not long ago, and it was found that much of his time out of school hours was spent playing baseball—the position he assumed "at the bat" accentuating in a marked degree all the deformities of the curvature. Hence the importance of keen observation of "contributory causes."

Muscular Weakness.—Notwithstanding certain previously mentioned conditions all tending toward the continued assumption of faulty postures, nevertheless their effect on an individual will depend upon the degree or extent of that particular individual's resistance. If the muscles are strong, they will exert much less influence than if the muscles are weak. A strong, sturdy physique will withstand influences which would quickly distort a weak and flabby one.

It might be well to draw a line of demarcation here, between (1) the development of a scoliosis from faulty postures caused by some physical or structural defect, and (2) that which is produced from factors of environment. In the first class there are mechanical disadvantages that cannot be con-

trolled, and a severe type of scoliosis is almost sure to result with surprising swiftness. Those in the second group develop more slowly, and usually not to such an extreme degree.

Occurrence.—The frequency of occurrence of scoliosis in boys and girls has been discussed at length; some authorities contending that it is more frequently found among girls than boys, for the reason that, as a general rule, from a constitutional standpoint they are not as strong as boys, and also that their muscular development is less. This, added to the fact that the bony structure of girls grows faster than that of boys at the period of adolescence, would seem to add weight to the theory. Girls are also more inclined than boys to be sedentary in their habits at this age. This, however, is not true in all cases; for there is the strong, athletic type of girl, and the weak, delicate boy who prefers to sit at home curled up over his books.

After all, through the establishment of higher standards of health and the emancipation of woman from past tradition which hampered her, the term “weaker sex” has logically become no longer applicable, so that it may be safely asserted that the terms “strong” and “weak” are individual rather than sex attributes. Based on this theory, it follows that lateral curvature of the spine will occur with equal frequency in both boys and girls.

Possibly the reason that a larger number of girls appear to be affected by this deformity is because attention is more frequently drawn to asymmetry of the figure in girls from the esthetic standpoint, and consequently they are brought more often to the notice of physicians and teachers of physical education for correction. This answers the argument of those who claim that all are equally affected.

Depleted Strength After an Illness.—This is a frequent cause of the conditions under consideration, the individual being

unable to stand erect because of the muscular weakness which allows the spine to sag again and again until a habit posture is formed which, if continued, will become permanent. In cases of muscular weakness—the muscles having lost the ability to support the structures properly—the strain is then brought upon the ligaments which in time become stretched, and the muscles become still weaker through disuse. It is the gradual yielding of “the outposts of our citadel.”

What is said by Dr. R. Tait McKenzie in this connection is so pertinent that we quote from him as follows: “The integrity of the spine is protected against the onset of deformity by three lines of defense of increasing strength: (1) The muscles forming an advance mobile series of outposts brought into service in relays, powerfully but intermittently; (2) the ligaments more resistant, but less mobile, require long-continued but persistent attacks to overcome their normal protective action; (3) the bones which may be compared to a citadel, yielding to the influence of deformity only after the other two lines have long since been carried.”¹

Soft Bone.—If faulty postures were constantly assumed when the resistance of the underlying structures is great, as in adult life, after the full growth of the bones had been attained, probably no harm would result. On the contrary, during the period of the growth of the child the bones are soft and plastic and easily molded into abnormal shapes by influences such as have been indicated.

There is also a pathological condition known as *rickets*, usually the result of poor nutrition, where there is a lack of lime salts, resulting in abnormally soft bone, which often underlies some of the severe forms of scoliosis. Osteomalacia, another condition of soft bone, may be present in some cases.

¹ McKenzie, R. Tait: Exercise in Education and Medicine.

Superincumbent Weight.—Another influence which must be considered of much importance is that of the superincumbent weight of the head and arms. This weight of itself does not tend to distort the spine, but on the contrary it is noticeable that those races among whom it is customary to carry heavy weights on the head are noted for their erect bearing. In some of the Oriental countries it is known to be a mark of the coolie or working class to have this noticeably erect posture, and for that reason, not to be desired for those of higher caste.

When the spine is straight and properly adjusted to the center of gravity, superincumbent weight tends to keep it still more erect. If there is any deviation to the side, then this weight being thrown out of alignment with the center of gravity becomes a powerful factor in increasing the distortion. This is important, as it is exerting its influence constantly during the daily life of the individual.

The study of the etiology of scoliosis must necessarily be cumulative in character, and consideration must be given to many contributing causes, which may be grouped as follows:

I. Malpositions.

1. Structural or physical defects.

A. Congenital.

B. Acquired.

2. Environment.

School, occupation, clothing, etc.

II. Conditions of soft bone.

1. Period of growth.

2. Pathological conditions (rickets, osteomalacia).

III. Muscular weakness.

IV. Superincumbent weight.

It has been briefly and comprehensively summarized by Dr. E. G. Brackett¹ as follows:

Physical defect	}	Faulty attitudes	}	Lateral curvature.		
Habits of position						
Growing periods (plastic stage)	}	Soft bone				
Abnormal bone (rickets)						

OLD THEORIES.

Some of the old theories in regard to the etiology of scoliosis are of interest, not only as showing the stages through which the study of this subject has passed, but also from the fact that many of them were merely imperfect, not entirely erroneous. Certain of these emphasized as important those elements which we now regard only as minor factors in the causation or increase of the condition. Cause and effect were often confused, and abnormalities resulting from scoliosis were mistaken for the cause.

Among the earlier writers on the subject, mention should be made of Hurter and Engell, who considered the underlying cause entirely due to abnormal or asymmetrical development of the vertebræ.

Guerin advanced the theory that spasmodic muscular action pulled the spine out of position in various regions. His treatment for correction was to cut muscles and ligaments on the concave side. This was a case where the result was mistaken for the cause.

Eulenberg thought that the important factor was muscular weakness on one side, with a resultant disturbance of balance and distortion of the spine.

¹ Reference Handbook of the Medical Sciences.

Rosa and Volkman claimed that the superincumbent weight of the body was the great predisposing cause.

Many other theories have been advanced from time to time. Present-day authorities agree that the reason for the development of scoliosis is not due to any one cause, which is applicable to all, or even the majority of cases, but to the influence of many factors. A difference of opinion exists only in regard to the relative importance which each may have as a primary or contributory cause. For example, some believe that the schools should be blamed to an extreme degree; others lay not so much stress upon this, and there are those who contend that the majority of cases are of congenital origin or due to rickets. It is still a subject for earnest thought and investigation.

EXAMINATION FOR SCOLIOSIS.

The preparation of the individual should be the same as that previously suggested for the examination of the antero-posterior conditions. However, we may emphasize here the following essentials:

1. The back should be fully exposed so that the relation of the trunk to the legs can be seen.

2. Since an examination through any part of the clothing is absolutely futile, whenever possible the removal of all apparel should be insisted upon. A loose robe can be thrown over the shoulders and be easily adjusted so as to expose only those parts necessary for observation.

We believe it is very pertinent to state at this point that, owing either to the careless methods of those responsible for making examinations, or their failure to realize its necessity, or to the ignorance of parents concerning its importance, a prejudice has existed and still exists against allowing any

examination of a pupil "undressed." But notwithstanding that this prejudice constitutes one of the greatest handicaps in the detection and correction of abnormal conditions among pupils in the public schools, nevertheless, through the earnest efforts of the teachers of physical education, this objection is being overcome, so that many schools now allow the pupil's back to be exposed for examination.

A pupil not infrequently asserts that an examination is unnecessary and will tell the examiner that all that is wrong is a high shoulder, and that she would like a few exercises to correct it. Such an assertion should never be accepted in lieu of an examination, nor exercises be given unless the actual condition has been seen. If by a persuasive and clearly interested manner such a girl can be so influenced as to desire and accept a thorough examination, it is within the limits of probability that a lateral curvature of the spine may be uncovered.

It is requisite that the pupil be placed for the examination so that the light will fall evenly on the back without any cross-shadows. The examiner's position should be such that the eye is about opposite the center of the back, in order to get the most advantageous view of the whole condition. The pupil should stand at ease with the weight equally on the two feet and the arms hanging at the sides of the body. It is often difficult to estimate a postural curve at once, as a person with a flexible spine under excitement or embarrassment of an examination may assume a variety of attitudes. The examiner should take plenty of time before making a decision, so as to be reasonably sure of the habitual condition.

The deviation of the spine may be noted by marking the line of spinous processes which can be felt through the skin, but care must be taken to mark exactly over each one and

not push the skin to one side. Other landmarks may be indicated if desired, such as the borders and angles of the scapulæ. A useful sort of pencil for use is an ordinary eyebrow pencil, obtainable at any drug store.

The eye should be trained by careful observation to recognize quickly lines of symmetry and asymmetry, so that the



FIG. 73.—Front view showing displacement of trunk in a left total scoliosis.

teacher will be able to decide promptly that the pupil is or is not normal. This is the initial step in an examination, which should be followed by a more detailed observation as follows:

1. Examine from the side, to detect any deviations in the antero-posterior plane.

II. Examine from the front. Frequently the body displacement is more apparent in this position. Distortion of the thorax should be noted, as to bulging, or depression of the ribs, and the regions involved. The breasts should be on a horizontal plane and a position of one relatively higher or lower shows spinal deviation. Position of head and lines of neck should be observed (Fig. 73).

III. Examine from the back.

1. General hygiene and muscle tone.
2. Flexibility: (a) General; (b) local (note regions where limited).
3. Feet. Any abnormalities. Arches.
4. Hips. Inequalities in prominence or height.
5. Arm-waist angle compared on both sides. (Inequality indicates body displacement.)
6. Scapulæ; unequal in height; unequal in distance from spine; relative prominence.
7. Height of shoulders; equal or unequal.
8. Lateral displacement of trunk over pelvis. This can be estimated by erecting a perpendicular from the gluteal fold.
9. Asymmetry of the lateral halves of trunk.
10. Lateral deviation of the spine as shown by line of spinous processes.
 - (a) Regions of convexities.
 - (b) Direction of convexities.
 - (c) Type: Postural; structural.
11. Rotation: Amount; location.

NOTE.—The test for rotation is to have the pupil bend forward, knees extended, in the so-called “Adams position,” which is a rounding over of the entire back with the arms falling forward, relaxed. Thereby the rotation is increased and the condition can be readily observed by placing the

eye at the same level and looking across from back to front, in the horizontal plane (Fig. 74).

It is advisable to examine the pupil not only in the erect position (especially in a structural condition), but also when lying prone—with arms at the sides of the body. While in this position it is well to exert manual pressure on the convexities and to observe the effect on the back. Finally, the individual should hang by the hands from a horizontal bar. The amount of correction accomplished by these tests will enable one to estimate the degree of the structural change,



FIG. 74.—Bending forward in the "Adams position," to show rotation.

the amount of flexibility, and the possibilities of improvement. A postural curve will entirely straighten under these tests.

In the standing position, we see the body as ordinarily carried, with the curves at their maximum of distortion, because the factors of fatigue, the influences of gravity, and the superincumbent weight are then present. While relaxed in the recumbent position all abnormal curves may disappear, because the stress incident to the maintenance of the erect posture has been removed.

The distinction must always be made between a *high* and a *prominent* hip, as they are not synonymous terms. The expression "high hip" is almost universally used to designate an apparent inequality, but in reality is of much less frequent occurrence than the prominent hip.



FIG. 75.—Prominent hip. (Result of sagging of trunk over pelvis.)

The *high hip* is a tilting of the pelvis occasioned by an actual difference in the length of the legs. The *prominent hip* is caused by the displacement of the trunk over the pelvis toward the convexity of the curve. On the concave side, the waist becomes sunken, causing a deep angle over the

crest of the ilium, and the appearance known as the *prominent hip* results. The importance of understanding this difference will be seen to have a direct bearing upon methods of correction, for while a prominent hip is the *result* of a spinal deviation a high hip is a *cause* (Figs. 75 and 76).



FIG. 76.—High hip. Produced by inequality in length of legs.

In order to ascertain the length of the legs in the case of a high hip, measurements by tape can be taken, lying on the back, and the distance from the antero-superior spine of the ilium to the tip of the internal malleolus noted. This has the disadvantage of the inaccuracy of all surface

measurements due to slipping of the skin. A good method of finding the relative difference in length of legs is to have on hand several blocks of wood, of graded heights varying from one-eighth to one inch in thickness, and placing one or more of them under the foot on the side of the short leg until the pelvis becomes even. A wooden caliper with spirit level attached is useful in determining inequality by adjusting its arms over the iliac crests.

This defect of the hip should be mechanically corrected by a lift of requisite height attached to the heel of the shoe; or better still by the use of a cork insole of the proper height at heel, tapering down to the ball of the foot. This can be slipped into any shoe, and is light and comfortable to wear.

RECORDS.

After an examination has been made, the results should be recorded and the various conditions represented in as graphic a manner as possible. Different methods and devices are in use for this purpose. The attempt to make records in terms of inches has been practically discarded. Measurements on the skin, by use of a plumb-line from which deviations of parts of the spine could be indicated, are subject to so many variations that they are considered of questionable value.

Many machines have been invented, some of them useful. The best known of these are the Schulthess and the Zander machines. The drawback to much of this apparatus is that it is usually complicated, and too expensive to be universally available. For making outline tracings, the pantograph is graphic and easily obtainable. Its principle is used extensively in many machines.

One method of recording the deviation of the spine is to attach a strip of *adhesive plaster*, three inches wide, to the

back over the spine all the way from the seventh cervical to the gluteal fold and to mark the line of spinous processes as they are felt upon this.

An easy way of obtaining a representation of the *rotation*, is by the use of a flexible lead tape, which is pressed around the back at the point of maximum rotation, and this outline is then transferred to cardboard. The distance down from the seventh cervical at which this is taken should be noted, and also the position of the spinous process indicated. Later records can be made and when superimposed any change observed.

The *schematograph* may be used to advantage for giving a general picture of the condition. The manner of making the drawing is the same as described in a previous chapter for the antero-posterior records. This has the advantage of being cheap and rapid.

Photography is perhaps the best means of record at our command. It gives the most accurate representation, and is very quick. Care must be taken that the individual shall stand in a plane parallel to that of the camera; that there shall be no twist, and that the light shall fall evenly.

A rubber stamp of the outline of the back as well as of the profile of the body is obtainable and useful for giving a diagrammatic delineation. All the asymmetrical features may be indicated speedily on the symmetrical outline stamped. This is especially valuable for the teacher's use as a quick reminder of existing conditions¹ (Fig. 77).

In addition to these records there should be noted the age, sex, height, weight, condition of the heart, type of individual, history of past disease, present physical condition and the habits. So far as possible information should be gathered

¹ Diamond Union Stamp Works, 175 Washington Street, Boston, Mass.

tending to shed light upon causes, which would be a guide in the process of correction.

A roentgen-ray picture is desirable, especially in structural cases.

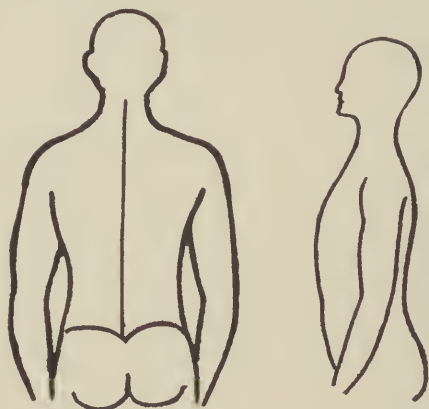


FIG. 77.—Rubber stamp for records.

PROGNOSIS AND TREATMENT.

Any lateral deviation of the spine should be regarded as a danger signal and as a condition demanding attention.

In considering the possibilities of the correction of lateral curvature of the spine, they may be grouped as to severity thus:

First degree—postural.

Second degree—slight structural.

Third degree—severe structural.

Postural curvatures without treatment may remain as they are. No hard and fast prediction can be made regarding them. Some disappear entirely, but in many instances they progress and become structural. *With treatment* a postural curve should be entirely corrected. A child with a postural

curve who is not taking treatment should be kept under observation, and any increase of such a condition ought to awaken one to the danger attending its neglect, and treatment applied at once. Do not trust to the luck that a child will outgrow the condition. It is a dangerous policy.

Structural curvatures in the young should always be regarded as serious, for they frequently increase, sometimes with startling rapidity, and may lead to great deformity. Therefore we cannot urge too strongly the danger of delaying treatment in cases of this nature. When slight and flexible, these curves may be greatly improved, and in many cases cured, by adequate and long-continued treatment. If of any severity, this calls for special exercises, if not daily at least two or three times a week during a long period of time, sometimes for years. Some exercise should be kept up during the entire period of growth. This must be aided by the hearty coöperation of the pupil and family with the teacher, and supplemented by work at home.

In the more advanced stages structural scoliosis cannot be cured, but may be improved, and usually can be arrested. When a scoliosis has advanced to the third degree and has become fixed, the bony structures cannot be altered, but exercises should be persisted in, as they will keep up the strength of the muscles, and prevent sagging of the back, which counts for a great deal in the appearance, comfort and activity of the individual. When the underlying cause is beyond the power of control, as is the case in infantile paralysis, it is almost impossible to prevent the advance of the condition no matter what means are employed. Persistent effort should be made, however, as lack of treatment would be disastrous. Relative to the treatment of structural scoliosis, one writer has said, "There is probably no class of abnormal conditions which comes under

the eye of the specialist which requires so much perseverance."

If a condition seeming to be structural lateral curvature has been observed, the advice of an orthopaedic surgeon should be sought before the responsibility of giving exercises for correction is assumed. On most occasions it is advisable to put the treatment into the hands of the specialist. Even in the case of a postural curvature of the spine, it is wise to have such supervision. A teacher of physical education should be informed of the name of a competent orthopaedic specialist in the locality, to whom pupils may be directed when necessary.

To the uninitiated, it often appears that the treatment of scoliosis means a routine lesson, once or twice a week, and the performance of a list of exercises, with the responsibility laid upon the teacher to remedy the condition in some miraculous manner. It is to be hoped that not many parents are as unthinking as the one who asked the writer not long ago if a "cure" could be "guaranteed in ten lessons!" Exercise is important, but it is only part of a program which must be preventive, corrective, and sometimes retentive as well.

Preliminary Factors in the Treatment.—In the first place we will reassert here the principle to which attention has been directed in a preceding chapter. It is this, The pupil must be induced to become interested to the extent of having "the will to do." It should also be impressed upon parents that their coöperation is essential and that, even for the improvement of a postural condition, lessons must be carried out over a considerable period.

After the lesson has been finished, exercises will be proved to have been of little value if the individual heaves a sigh of relief, sinks down on one foot, throws the hip into prominence,

and then walks out of the gymnasium in such a manner as to accentuate all the incorrect features of the condition.

A background of health on which to build is essential to success. Hence all the factors of the environment should be studied and predisposing influences be eliminated. It is most important to look for vicious habits of standing and sitting.

Mention has already been made of the influence of school conditions, and as long as these and other elements of the environment operate to handicap us in the treatment, just so long will we be unable to obtain the best results in the correction of lateral curvature of the spine. Therefore, it cannot be too strongly urged that a child with a scoliosis of any degree should be relieved of many of his burdens: that school requirements be reduced to a minimum, with plenty of time for rest and play; and that the business of life, for the time being, should be that of giving attention to the correction of the curvature. If these changes are promptly effected, progress will be greater, the result more speedily attained and more satisfactory in the end. Few parents, however, are willing to make such a "sacrifice" of time at school, and frequently the child is still further taxed by the addition of special exercises to an already overfull program.

When treatment is conducted in sanitariums results are likely to be far more encouraging; for not only are daily lessons given, but the hygiene is controlled, pupils have plenty of fresh air, good food, sufficient sleep and recreation, essentials of primary importance in treatment.

Treatment by Exercises.—Having taken *preventive* measures, the *corrective* treatment by exercises should follow. This must be planned with reference to the type of curve: first, second or third degree.

Here also the general health and strength of the individual should have consideration, likewise any condition noticed during the examination which may require a modification of the exercises. The heart should always be tested.

The lines along which it is then essential to work are:

1. For improvement of the general condition.
2. Equalization of flexibility.
3. Strengthening muscles.
4. Readjustment of muscular control.

In the treatment of all degrees of lateral curvature asymmetrical exercises are being used less than formerly and much attention is being given to training the pupil to assume the correct position as nearly as possible, and then by symmetrical exercises strengthening the muscles to hold the position. The reestablishment of a desirable neuro-muscular control is thereby gained, which replaces the faulty coördinations of asymmetry.

Type of Exercises for Postural Scoliosis.—A few exercises for improving flexibility should be given and then training (preferably before a mirror) for the symmetrical position. This is a very valuable part of the program. Time and again the individual is shown the proper adjustments. At first he is assisted by the teacher who touches lightly the maximum point of the curve, suggests the correction of the body displacement, calls attention to inequalities of the shoulders and so on, asking the pupil to take a position correcting these defects as nearly as possible. Then after a moment, in which to relax, he is instructed to take the position again, and finally to make an excursion around the room holding the improved position. Little by little the pupil "gets the feeling," and if this effort is persisted in at other times much of the battle is won.

A program should be planned for its hygienic as well as

for its corrective value. It should never be composed entirely of specialized exercises, but arranged with reference to its physiological effect on the entire body.

Type of Exercises for Structural Scoliosis.—In giving exercises for the correction of a structural scoliosis, it is not considered advisable to increase the flexibility of the spine to too great an extent, unless some retentive apparatus is to be worn. Such increased flexibility permits the spine to sag out of position still farther, at times when the individual is unable to make the muscular effort necessary to counteract the ever-existing tendency. When it is advisable to work for flexibility in a condition of extreme stiffness, it will need to be done by the use of some sort of mechanical apparatus, of which there are many. These are used to a considerable extent in the gymnasiums of the orthopaedic surgeons and in hospitals where such work is done. Although applied in various ways these machines embody certain principles, mainly those of traction on the spine and pressure on the convexities of the curves.

Forcible Correction by Plaster Jackets.—This method is used to some extent by all orthopaedic surgeons under certain conditions. A plaster jacket is applied to the patient who is placed for the purpose in a position of maximum correction. This correction is obtained, in various ways, by suspension, or in some recumbent position, with the spine relieved of the weight. All supports of this nature must be worn for a certain length of time, amounting to years in many cases, and should be renewed frequently, at the discretion of the surgeon. They are made usually with openings, or “windows,” opposite the regions of the concavities, back and front, which permit expansion of the hollows through respiration. Pads of heavy felt can likewise be inserted in such a manner as to exert still further pressure on the convexities.

After the condition has improved, this type of support may be replaced by a *removable jacket*, which may be made of plaster, leather, or celluloid, reinforced sometimes with steels and straps. Removable supports make it possible to exercise the muscles, which is most important. One of the disadvantages of the permanent support is the loss of strength through the inability of the individual to exercise the muscles concerned in holding the spine erect.

Retentive Treatment.—Removable jackets and braces cannot be depended upon to give much correction, but they are of value in holding the back in its best position and in preventing an increase of the deformity. Treatment combining exercises with the wearing of a removable support has been widely used and has been found a fairly effective means of dealing with structural scoliosis.

Braces are sometimes worn, but are never very satisfactory. It is almost impossible to construct a brace in such a manner as to obtain the requisite leverage for pressure, without being so constricting as to cause great discomfort. The individual is thereby tempted to loosen the straps and to make adjustments for comfort which allow the brace to slip, and eventually it is liable to do more harm than good.

Apparatus advertised in stores or in the press should be avoided. A brace, or support of any kind for the correction of such a complicated condition as scoliosis, should be fitted to the individual by a skilled surgeon.

Operative Measures.—For some time surgeons have operated occasionally on the distorted bones in cases of extreme deformity, but this has not been done to any great extent until within the past few years. An operation originated and performed by Dr. Hibbs, of the New York Orthopaedic Hospital, seems to mark the opening of a new field of treatment in certain cases. After the deformity has been

corrected to the greatest possible degree, the operation is done. By it a fusion of the vertebrae is obtained, eliminating motion in the joints of the deformed area, thus preventing the progress of the deformity. This forms a sort of natural brace, as the spine remains fixed in the corrected position. This treatment has special advantages, as it eliminates for many individuals the long-continued wearing of braces or jackets, removes much mental anxiety, and prevents an increase of the deformity.

An extreme scoliosis is one of the most distressing of burdens to be borne, shadowing many lives, sometimes even from early youth. The wearing of heavy apparatus, the distortion of the figure, long-continued corrective exercise treatments, year after year, and the ever-deferred hope of recovery, all make us wish for some far better means for correction than any that are known and available at the present time.

SUMMARY.

In the experience of those who have given the subject careful consideration, the treatment of scoliosis may be resolved into three lines of procedure, one or more of which may be necessary, depending upon the condition to be corrected.

1. Exercise.
2. Use of some sort of apparatus (corrective or retentive).
3. Operative measures.

THE PAST HISTORY OF SCOLIOSIS.

The past history of scoliosis shows that from the earliest times, it has been a recognized condition, though only within the last hundred years or so has it been separated from deforming disease of the spine. As early as 400 B.C. Hippoc-

rates classified curvatures and advocated methods of treatment, thereby showing certain principles which are still the foundations of correction, though the methods of his time were much more crude.

The work of Dr. Paré in the sixteenth century is of interest. He then asserted that "faulty garments" and "undecent postures" were causes of lateral curvature. He also recommended treatment in this manner: "The remedy for this deformity is to have breast plates of iron, full of holes all over, whereby they may be lighter to wear, and they must be so lined with bombaste that they hurt no part of the body. Every three months new plates must be made. But these plates will do them small good that are already at full growth." The work at that time was put into the hands of skilled armorers.¹

EXERCISES FOR CORRECTION OF LATERAL DEVIATIONS OF THE SPINE.

For the correction of both postural and structural lateral curvature of the spine, the type and arrangement of exercises in the program will be similar to that used for the correction of the antero-posterior faulty postures. The aims are, as in those cases, to increase flexibility, to strengthen muscles in order to hold the corrected position, and to train the new neuro-muscular coördinations.

It will be found that in the correction of lateral deviations, correction of the antero-posterior posture is usually the major part of the problem, since in both postural and structural lateral curvature there is generally an accompanying faulty posture of this type.

¹ Bigg, Heather: An Essay on General Principles of the Treatment of Spinal Curvature.

PLAN OF THE EXERCISE PROGRAM.

1. Introductory:

Exercise to induce deep breathing.

Relaxation exercise.

Posture training.

2. Exercises for general flexibility.

3. Exercises for local flexibility. (Lateral and antero-posterior.)

4. Self-correction. (Assisted by teacher at first. Also to be done before mirror.)

5. Exercise for strengthening back, in the corrected position.

6. Abdominal exercise.

7. Relaxation. (Hook-lying position.)

8. General exercise for strengthening muscles in corrected position.

9. Posture training.

10. Practice balance exercises of various sorts. Also walking in good posture.

Relaxation—lying.

At the conclusion of every lesson the pupil should be asked to assume, by his own effort, the utmost correction and best posture possible. The mental impression of the end and aim of the lesson is then much more definite. At the same time admonitions as to the importance of frequent effort at home should be given by the teacher.

A large part of the program should be devoted to training the sense of the correct position and to strengthening muscles by symmetrical exercises to hold the position. The exercises indicated in Chapter VII will be found available for this purpose.

As symmetrical are now used more generally than asym-

metrical exercises in the correction of lateral deviations of the spine, only a few of the simpler and more useful of the latter will be described here. These are for the purpose of increasing lateral flexibility. It is a difficult matter to localize asymmetrical exercises, especially in the case of a compound structural scoliosis, so that correction of one curve may not produce exaggeration of the other. It is not desirable to increase flexibility to too great a degree, as it may act as a factor for evil rather than good. Unless the back can be held in the corrected position made possible by increased flexibility, this very flexibility will allow the spine to sag out of position still farther and to succumb to the influence of outside forces. Exercises should be worked out carefully, and rigidly supervised, otherwise they are not only useless but may be harmful.

Exercises in suspension are given to a considerable extent because traction on the spine by the body weight tends to straighten it.

EXERCISES FOR INCREASING FLEXIBILITY. (ALL
EXCEPTING 1 AND 2 ARE ASYMMETRICAL.)

1. Passive hanging from horizontal bar. (See Fig. 33, Chapter VII.)
2. Head suspension by use of the "Sayre" head sling. (For structural curves.)

NOTE.—This should always be supervised (Fig. 78).

3. Side falling at rings (Figs. 79 and 80).

Position.—Grasp rings. Elbows slightly bent. Feet on floor.

Movement.—Trunk bent to side of existing convexity. (As illustrated, trunk bending to left, for correction of a left total curve.)



FIG. 78.—Sayre head-suspension apparatus.

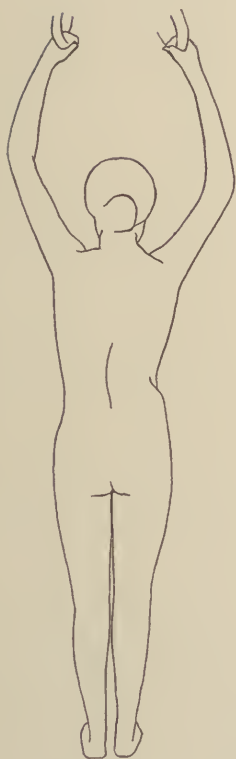


FIG. 79.—Total curve.

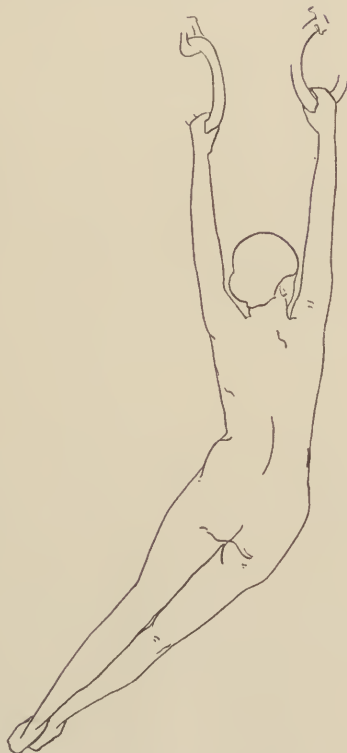


FIG. 80.—Side falling.

4. Standing. "Keynote position," asymmetrical arm extension (Fig. 81).

Position.—Hands at shoulders; elbows at sides of body.

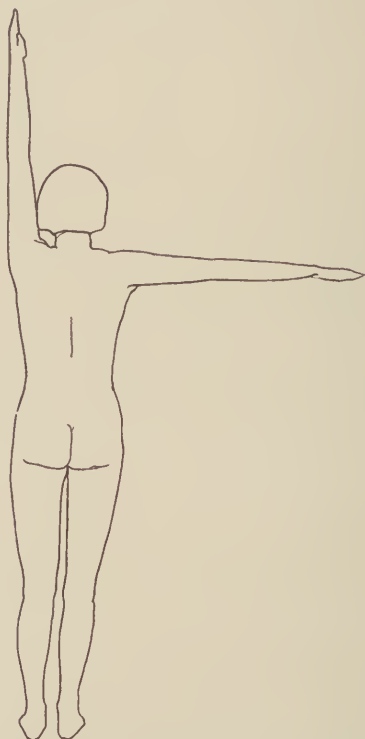


FIG. 81.—Correcting a convexity to the right, with low left shoulder.

Movement.—Arms extended slowly; the arm on the side of the low shoulder is extended upward, the other arm sideways. This may be varied to meet requirements sometimes encountered by extending arms in other combinations of positions. Trial

must be made with each individual until the best correction is obtained.

5. Sitting. Side bending (Fig. 83).

Position.—Sitting. Hand at neck (low shoulder).
Other hand on convexity of curve.

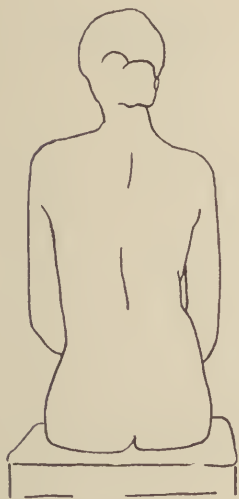


FIG. 82.—A left total curve to be corrected by exercises.



FIG. 83.—Side bending of trunk.

Movement.—Bend to side of convexity, exerting pressure with hand, 10 times. This exercise may be performed also in the standing position. Another variation is to stand with the convexity of the curve against a horizontal bar. Bend to side, over the apparatus, allowing the arm on that side to hang free, with other hand at neck. This gives more forcible correction.

6. Pushing dumb-bell upward (Fig. 84).

Position.—Sitting. One hand on hip; one hand at shoulder, holding dumb-bell (2 to 4 pounds).

Movement.—Extend arm slowly upward (on side of concavity). Return to shoulder without relaxing the muscles of the back. Repeat as long as good position can be held.



FIG. 84.—Slow arm extension upward with heavy dumb-bell.

7. "Spring sitting" position. May be used for the correction of either postural or compound structural conditions. Must be adjusted carefully to individual needs.

Position.—Sitting on edge of stool. Forward leg bent at right angle.

Movement.—Other leg extended backward; one arm extended upward; one arm extended downward or sideways. Hold position a few seconds; relax; return to first position and repeat 5 to 10 times (Fig. 85).

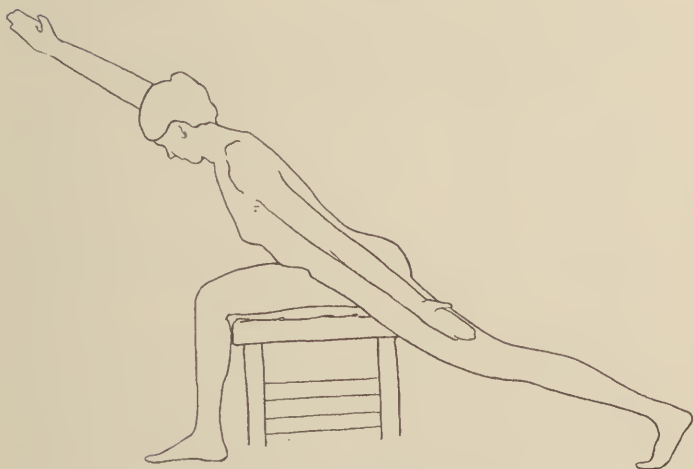


FIG. 85.—Spring sitting position.

8. Standing. Forward fall out. A variation of the preceding exercise.

Movement.—Forward knee bent at right angles. Other leg extended backward. Trunk inclined in line with backward leg. Arms extended to keynote position.

TYPICAL PROGRAMS OF EXERCISES FOR SCOLIOSIS.

(SUBJECT TO MODIFICATION.)

POSTURAL LEFT TOTAL CURVE.

1. Relaxation exercises (body-freeing).
2. Stationary running (to induce deep breathing).

3. Correction at mirror (with assistance).
4. "Bicycle" (general flexibility).
5. Trunk bending to left; sitting or at rings.
6. Arm extension to "keynote position."
7. Practise self-correction.
8. Standing in corrected position. Raise arms sideways, holding heavy dumb-bells (general strengthening).
9. Lying on mat. Knee bending (abdominal).
10. Active hanging. (Strong back exercise.)
11. Mosher exercise.
12. Self-correction. Walking—holding correct posture.

STRUCTURAL RIGHT DORSAL-LEFT LUMBAR SCOLIOSIS.

1. Relaxation exercises (body-freeing).
2. Jumping-jack exercise (to induce breathing).
3. Passive hanging (flexibility) or a recumbent pressure exercise on apparatus or by instructor.
4. Spring sitting (carefully worked out).
5. "Bicycle."
6. Mosher exercise.
7. Practise self-correction with aid of teacher.
8. Lying on back. Knee circling or knee bending (abdominal).
9. Arm extension to "keynote position."
10. Sitting; hands on head; spine stretching; or sitting with iron bar extended upward; pull downward slowly and forcibly behind shoulders.
11. Self-correction; walking, etc.
12. Rest in relaxed position on mat.

CHAPTER XI.

THE FEET.

MECHANISM OF THE NORMAL FOOT.

BEFORE considering some of the abnormal conditions of the feet, it is well to go over, briefly, the normal mechanism. The human foot is a structure consisting of twenty-six small bones joined by ligaments and muscles so adjusted as to give the best conditions for weight bearing and elasticity of gait. A great burden of responsibility rests upon them, for they must act as a base of support and as a means of locomotion. In the busy life of the present day this means almost constant use.

The bones of the foot are arranged in three groups:

1. Bones of the tarsus or tarsal bones. These are *os calcis*, or *calcaneum* (the large bone of the heel). *Astragalus*, directly above the *os calcis*, articulates with the tibia and fibula to form the ankle-joint. *Scaphoid*, also called the navicular bone. *Cuboid*. *External*, *middle* and *internal cuneiform*.

2. Bones of the metatarsus or metatarsal bones (five).

3. The phalanges or bones of the toes (fourteen).

The arrangement of these bones is such as to present two well-marked arches.

ARCHES OF THE FOOT.

The *longitudinal arch* extends from the heel forward to the ball of the foot, and is called, commonly, the "instep."

The *transverse, or anterior arch*, formed by the heads of the metatarsals, is at right angles to the longitudinal arch just back of the toes.

The longitudinal arch is supported by strong ligaments on the under or plantar surface of the foot. Two of these, the calcaneo-cuboid (called by Gray the long and short plantar ligaments), are, next to the ligamentum patellæ, the strongest in the body. These bind the os calcis to the cuboid and to the last three metatarsals on the outer side, so that this part of the foot is held firmly and acts almost as one piece, while the inner side is more free and most of the

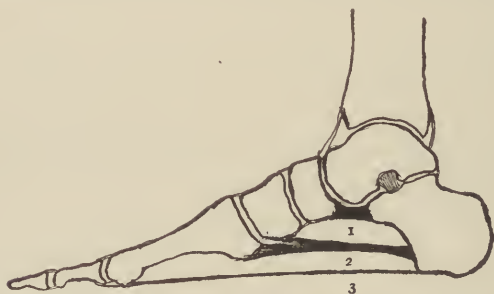


FIG. 86.—Antero-posterior arch: 1, short plantar ligament; 2, long plantar ligament; 3, plantar fascia. (R. Tait McKenzie.)

support is muscular (Fig. 86). The arched contour is preserved not alone by these ligaments and the plantar fascia, but by the action of several muscles. These are the short muscles on the sole of the foot, aided by muscles connecting the foot with the tibia—notably the tibialis anticus and tibialis posticus.

SHAPE OF THE FOOT.

The shape of the normal foot is triangular, with the apex of the triangle toward the heel and the broad part forward

at the toes. The weight of the body is borne upon three points: the heel, base of the big toe and base of the little toe.

In savages and infants the foot is almost fan-shaped and has a wide range of movement, also considerable prehensile power. Savages use the straight foot position, and the manner of walking in the case of races which are unhampered by shoes is by strong flexion of the anterior part of the foot, almost digging the toes into the ground at each step, propelling the weight of the body forward by a strong push with the great toe.



FIG. 87.—Primitive foot unhampered by shoes. Note fan-shape.

Between these unshod races and civilized man there is, in most instances, a great difference in the shape and use of the foot. In conformity to the decrees of fashion, this is brought about by wearing shoes improperly shaped which crowd the toes together and press the big toe into such a position that it can no longer functionate to advantage. The result is not only a deformed foot, but one that has lost much of its elasticity and capacity for comfortable use.

STRAIGHT POSITION OF THE FOOT.

The position of the foot in standing and walking has an important bearing upon its strength and usefulness. It is

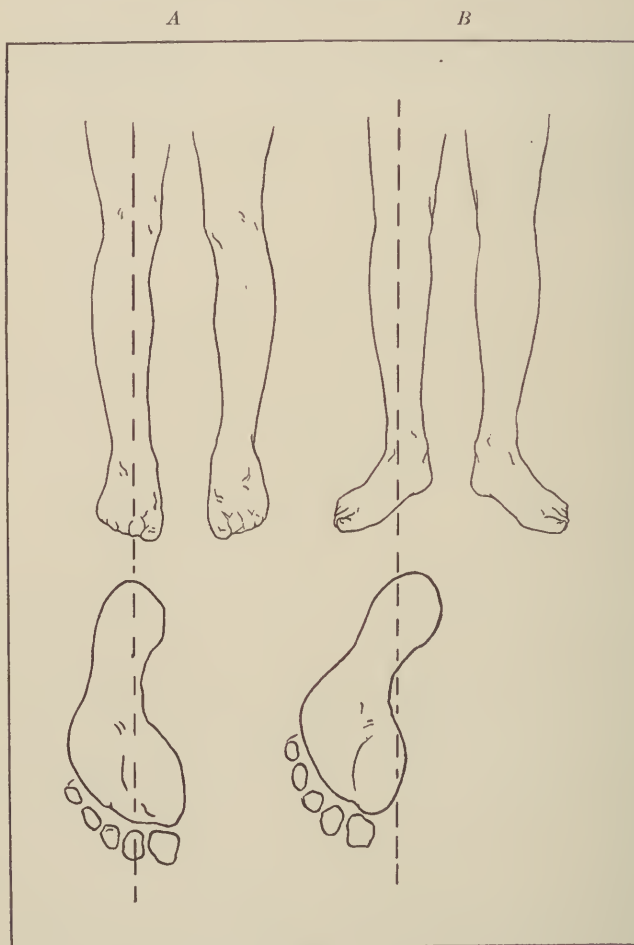


FIG. 88. — *A*, strong position, feet straight; *B*, weak position, feet turned out.

now generally admitted that keeping the "toes turned out" which has been taught to the young for generations, should not be encouraged, as it is one of weakness. The position of the feet with the toes pointing straight ahead is more natural and stronger.

An analysis of the mechanics of walking shows that the weight of the body as it is carried forward, in order to be transmitted in the most economic manner, must pass through the center of the hip-, knee- and ankle-joints and the long axes of the femur and tibia of the advanced foot. This is done by extension of the hip and knee of the posterior leg, the body weight being lifted by strong extension of the ankle, carried through the long diameter of the foot to the big toe and by means of its leverage, the body is propelled onward. If the position of the foot is pointed straight ahead, then the weight falls along the whole length of the arch, with the advantage of the leverage of the big toe. With the toes turned out, the weight falls upon the foot at an angle striking a point at about the middle of the longitudinal arch, the anterior part of the foot takes little part in weight bearing and the leverage of the big toe is lost. Strain is apt to result, or at least, there is not the most economic use of the foot as it is working at a mechanical disadvantage. This position also tends to shorten the tendon of Achilles, still further weakening the foot. If the foot weakens under the strain of this position there will be a tendency for it to turn out still more, and so a "vicious circle" has been established (Fig. 88).

This theory is borne out by the instinctive tendency manifested when there is insecurity of one's stance. For example, if the feet are slipping on an icy pavement, the natural reaction is to turn them in, and to endeavor to grip the ground with the toes. Other instances may be found in

certain works of art in which the painter or sculptor wishes to give an impression of strength. This is clearly shown by the statue of Farragut, standing on the deck of his ship (Fig. 89). Another advantage of the straight foot position is that progress can be made faster.



FIG. 89.—St. Gauden's statue of "Farragut," showing strong position of the feet and strong erect posture.

ABNORMAL CONDITIONS OF THE FEET.

In studying abnormal conditions in which the longitudinal arch is concerned we find three types—the weak foot, the

strained foot and the flat foot, sometimes designated as the "fallen arch."

The Weak Foot.—This might be called a postural defect of the foot, a condition of relaxation of the muscles that allows a slight displacement downward of the bones. It will probably appear to be a normal foot when not bearing weight. Such a foot becomes easily fatigued and may be swollen, though there may be little or no pain present. On examination it will show a slight tendency to roll toward the inner side when the weight is placed upon it (pronation), but if measures are promptly taken in adjustment of shoes and in performing simple exercises, the trouble will go no further and normal conditions may be restored easily. Many children show a tendency to weak feet. It accompanies a condition of general muscular weakness and is frequently a concomitant of faulty postures.

If allowed to persist weak feet soon pass to the next stage and become strained.

The Strained Foot.—As the foot becomes increasingly weaker, it is less able to meet the demands of the person's activities and the muscles relax further. The strain then falls upon the ligaments, inward rolling becomes more pronounced and some pain will probably be manifested.

The Flat Foot.—The final stage of a progressively weak foot is the typical flat foot, or "fallen arch." In this stage the muscles and ligaments no longer hold the bones in their correct relation becoming relaxed and strained until often no semblance of an arch remains (Fig. 90). Pressure then falls upon nerves and bloodvessels and a painful condition results. The foot becomes increasingly stiff until nearly all elasticity and flexibility in the foot and ankle joints are lost. Walking becomes awkward with, perhaps, little motion in any of the joints excepting the hips. The char-

acteristic gait accompanying this condition has been picturesquely described as the "pedestal walk." Undue strain is thus brought upon other muscles, with accompanying nerve irritation, so that pain is frequently distributed to remote regions, as for example to the hips, knees or back.

Not infrequently pain supposedly of rheumatic origin may be traced to flat feet.



FIG. 90.—A flat-foot.

In extreme cases the following conditions will be present:

1. Pronation of the foot (a combination of eversion and abduction).
2. Prominence of inner border (scaphoid projects).
3. Stiffness of foot and ankle.
4. Short tendo Achillis.
5. Abduction of great toe.

Such a foot tires easily, there is a tendency to avoid locomotion, and considerable pain is present, which is usually more noticeable when first getting up in the morning. This is caused by putting the weight on the weakened structures, which, having been relieved of their burden during the night's rest, suffer anew when again subjected to strain.

There is a type of *painless flat foot* to which attention should be called. This seems to be a normal condition with some people, notably negroes. There are no perceptible arches, and the entire sole of the foot is in contact with the ground. Such a foot may be strong but will never have the elasticity or grace of the other type.

The height of the arch in a normal foot varies with individuals and is not always an indication of the strength of the foot. A normally low arch may be stronger than one normally high and a teacher should learn to discriminate between an arch normally low and one which is relaxed or falling. The infant's foot often shows no arch. This is due to a thick pad of fat on the sole, and is also because the muscles have not been used in walking.

ETIOLOGY.

In discussing the shape of the foot the effect of civilization has been noted, and it may be stated here that the causes of weak, strained and flat feet are found as the outgrowth of civilization to a large extent. The demands of modern life, improper shoes, the necessity for walking and standing on hard pavements, each may be a contributory factor.

We are told that weak or flat feet is another one of the penalties of the upright posture. Quadrupeds are supported on four extremities in the horizontal position, using all four feet in their activities, while man supports his body in much less stable equilibrium on two feet and is still further hampered with shoes which frequently cramp them and interfere with their normal functions.

The disproportion between the strength of the structures and the strain to which they are subjected is doubtless the

primary cause of flat foot. It is of frequent occurrence in people who are on their feet a great deal. Nurses suffer from this, as their duties necessitate standing for long periods on the hard floors of hospitals. Policemen are likewise noticeably troubled and many of them show the characteristic gait. This fact has been recognized by the city officials of New York, and excellent pamphlets have been issued to all members of the police force, calling attention to preventive and corrective measures and giving advice in regard to shoes. At headquarters, exercises are given daily in connection with the setting-up drill and the men are encouraged to seek advice and help.

Increase of weight is another cause. This is apt to occur as a person grows heavier toward middle age, and there is less elasticity in the tissues. The extra burden is too great and the structures give way. An *acutely strained or flattened foot* may result from throwing the weight suddenly upon the foot, as sometimes happens in the gymnasium when landing too heavily from a jump.

In order to account for the noticeable prevalence of weak feet in children, a theory has been advanced that some of the play activities of city children on hard pavements may be in a measure responsible—much jumping—the use of the roller skate, which allows the foot to roll inward, etc. These conditions and likewise the sort of shoes worn by children ought to be investigated as to their influence upon feet in their plastic growing state.

Summary of Contributory Causes.

1. General muscular weakness.
2. Mechanical disadvantages of weak position of the foot in walking.
3. Overweight.
4. Faulty shoes.
5. Acute strain.

Examination.—The pupil stands with feet bare, weight equally on both, and the legs exposed just above the knees, so that the relation to the feet may be observed. Examine from the front, noting any tendency to pronation. From the rear this may be seen readily by the alteration in the line of the tendo Achillis, which instead of making a straight line down the center of the heel curves outward (Fig. 91).



FIG. 91.—Showing one of the first signs of flat foot. The outward deflection of the lower end of the tendo Achillis when weight is put on the foot. (E. H. Ochsner.)

The pupil is asked to walk a short distance and the position and action of the feet are noted. Painful and fatigue symptoms should be investigated. Then, with the pupil sitting, the teacher manipulates the foot to ascertain whether the flexibility is normal, testing especially the ability to adduct and invert the foot. The length of the tendo Achillis is tested by forcible flexion of the ankle with knee extended.

This tendon is noticeably short in many cases, and, by limiting the flexion of the ankle, becomes a factor in weaken-



FIG. 92.—Imprint of a normal foot.

ing the foot. Normal flexion of the ankle should be to about 10 degrees beyond a right angle. If in walking, there is restriction of this action, the length of the stride

will be limited. In order to increase this, there will be a tendency for the foot to bend at the mediotarsal joints to turn outward and finally to pronate.



FIG. 93.—Imprint of a flat-foot.

RECORDING.

An imprint of the foot is usually taken, although all records of this sort have a limited diagnostic value. This

may be done in several ways, but it is sufficient here to notice only the following:

One method is to paint the sole of the foot with a solution of iron, a *formula* for which is 55 per cent tincture of chloride of iron; 40 per cent alcohol; 5 per cent glycerin. The pupil then stands upon a sheet of heavy cardboard, to which the impression is transferred. A more satisfactory method, which has the advantages of quickness and cleanliness, is by the use of a piece of apparatus, the "Pedograph" machine.¹ This is made in the form of a small flat box, the top covered with a thin sheet of rubber which runs over an inked roller. Under this rubber a sheet of paper is inserted, upon which a print of the foot is made by having the person stand on the machine, bearing the weight of the body on the foot for a moment (Figs. 92 and 93). It is interesting, as an object lesson, to superimpose an outline drawing of the shoe over a print of the foot, and often impresses an individual when asked to draw conclusions (Figs. 97 and 103).

TREATMENT.

The treatment, depending upon the condition, is carried out by the following methods:

1. Adjustment of shoes.
2. Massage.
3. Exercises.
4. Support of the foot by artificial means.

Massage.—Massage is useful when a painful condition is present or where there is swelling and congestion. It is applied not alone to the foot but to the lower leg also for improvement of the circulation.

¹ Made by Scholl Mfg. Co., New York.

Exercises.—Passive exercises should accompany or follow massage and as the foot improves, active exercises should be substituted. If a foot is stiff, considerable passive manipulation would be advisable in order to limber up the entire structure. Active exercises are of value in toning up the muscles and restoring normal posture and function. These exercises should be few and simple, but persisted in faithfully.

The straight position of the foot in walking and standing should be stressed as a factor in the treatment. However, it is not always advisable to give exercises as the routine treatment. A painful foot, or one that is weak from tired muscles, may need complete rest. In this situation, massage, warm foot baths, correctly fitted shoes and rest would be indicated. Here, as elsewhere, there should be no hard and fast rules in the application of individual exercises. Discernment and discretion on the part of the teacher are essential.

"Arch Supports," or Plates.—These are of various sorts and of relative value. They should be used as an adjunct to other treatment and worn at times when the foot is liable to be under extra strain. For the relief of an acute condition it is advisable to use them temporarily. The objective in every case should be to improve the strength of the foot by exercise so as to depend upon the support less and less until it can be dispensed with altogether.

The types of supports or plates are too numerous to be described in detail, although two may be mentioned:

One sort is made on the principle of correction of the position of pronation by holding the os calcis firmly, and by preventing its rolling, to stabilize the position of the entire foot.

Another kind has flanges so arranged on either side that

they make uncomfortable pressure if the foot is not held in the position of inversion and adduction.

All supports are cumbersome, but if worn, should be made from a cast of the foot, under the supervision of a specialist. Those sold in stores and advised by shoemakers should be distrusted. Any support should be only high enough to hold the arched position of the foot without giving pressure to any extent, the object being to prevent the sagging of the foot when the weight is borne upon it and not to force the arch upward abnormally.

In the treatment of severe flat-foot it may be necessary to advise the use of a support constantly, at first, to relieve the strain and painful symptoms.

Sometimes it is beneficial, especially with children, to raise the inner border of the shoes, thus throwing the weight on the outer borders in order to counteract the tendency of the feet to roll inward into a position of pronation. This is accomplished by inserting a lift along the inner margin of the sole, also raising the heel on the inside and projecting it forward slightly. This is called the "Thomas heel."

ANTERIOR METATARSALGIA.

The so-called anterior arch of the foot passing transversely across at the forward ends of the metatarsals gives a slight concavity to that part of the sole of the foot. This arch frequently becomes flattened. As a result the heads of the metatarsals come heavily in contact with the ground at each step, a certain amount of elasticity is lost and calluses are liable to be formed on the sole of the foot. In the altered position the bones are not held firmly and are apt to slip and exert pressure on the nerves. This condition

is known as anterior metatarsalgia, or "Morton's toe." It is characterized by acute pain localized under the heads of one or more of the metatarsals (usually the fourth) which radiates to the entire foot. The pain is usually sudden in its onset, and may be of such severity that relief cannot be gained until the shoe has been removed and the foot manipulated, so that the bones are adjusted and pressure on the nerves released.

Causes.—Poorly shaped shoes, especially those too short, or those with pointed toes and high heels, are the chief cause of anterior metatarsalgia. The high heel throws the weight of the body forward upon the anterior part of the foot, pressing it downward. The foot is forced forward into the pointed toe, where the ends of the toes are cramped together and held in such a manner that spreading and flattening of the anterior arch is still further aggravated. Prolonged standing, especially in such a type of shoe, is a contributory cause. This condition may also originate by landing heavily on the forward part of the foot, if there is not the proper lightness and spring in the body. *A position to be avoided*, in which women sit frequently, which is strikingly pernicious in its effect upon the anterior arch, is illustrated in Fig. 94, p. 208. The feet are braced on the floor, bent in such a way that there is a strong downward pressure which flattens the anterior arch, and the ankle is forcibly extended, shortening the tendo Achillis. This position is usually accompanied by a poor sitting posture. As is the case in the relaxation of the longitudinal arch, the causes in general may be said to be the disproportion between the amount of work to be done, the strength of the structures and the mechanical disadvantages owing to shoes.

Anterior metatarsalgia occurs more frequently in women than in men.

Treatment.—Suitable shoes should be the first consideration. The proper type is one which is fairly snug across the



FIG. 94.—Faulty position of feet; straining the anterior arch; shortening the tendo Achillis.



FIG. 95.—Method of adjusting pad and bandage for relief of anterior metatarsalgia.

region of the anterior arch but wide at the toes. Sometimes a support may be necessary. This should be made with a

prominence which will exert an upward pressure under the metatarsal affected. A pad of felt about an inch in diameter and a quarter to a half an inch in thickness can be adjusted to give relief. The pad is placed on the sole of the foot posterior to the painful spot and is held in position by a strip of adhesive plaster bound snugly around the foot over the metatarso-phalangeal joints, preventing the spreading of the foot in this region. Or it may be permanently attached to a leather insole which can be slipped into the shoe (Fig. 95).

HALLUX VALGUS.

The outward manifestation of this condition is the enlarged joint of the great toe which has become abducted. It is caused by shoes—either those too short or with toes narrow and pointed. A hallux valgus is not curable except by operation. The deformity may be somewhat improved by wearing shoes with straight inner borders and low heels. There must be no pressure which might tend to force the great toe outward.

A bunion is the result of inflammation of the synovial bursa of the joint and is accompanied by swelling, pain and extreme tenderness. It is usually the accompaniment of a hallux valgus.

The treatment of this condition is to allay the inflammation, remove pressure by adjustment of shoes and the arrangement of a pad to fit around the swelling to protect the sensitive area from pressure and injury.

CHAPTER XII.

SHOES—EXERCISES FOR THE FEET.

SHOES.

IN medical and physical education circles, also among those interested in problems of hygiene, and even with the laity, there is probably no subject more frequently discussed than that of shoes. It cannot be too positively asserted that the subject is one which demands serious thought, for no article of dress may exert so pernicious an influence upon the whole bodily mechanism as improper shoes—*especially women's shoes*. Intended originally to cover the feet and protect them from injury, they have, in many instances, become not alone deforming casings, but even instruments of torture.

The essential features of a good shoe and the results consequent upon wearing a poorly shaped one are therefore matters for earnest consideration. One authority describes a proper shoe as “one which supports the foot in its normal position when at rest, and allows the normal motions to take place during activity.”

The endeavor should be to get a shoe as nearly as possible the shape of the foot and which therefore fits it, rather than a shoe, which, perhaps, appeals more strongly to the eye, but to which the foot has to be adjusted by crowding and pressure in various directions. Through false standards of beauty and slavery to fashion, we often fit our eyes instead of our feet: There is, however, no reason why a “good shoe” must necessarily be ugly in appearance.

Such a stigma, long attached to shoes known as "common sense" and "orthopaedic," has prevented their universal adoption. Many of them were awkward, heavy and needlessly clumsy. In many instances also they were much more expensive than other types of shoes. Incidentally let us admit that it is an error to be too extreme in any direction. Sensible shoes on modified lines are now made, and being more sightly in appearance, will tend to increase a popular demand. We should not be satisfied with a "good" shoe at the expense of appearance, but obtain a good shoe plus a good appearance.

It is not possible to recommend arbitrarily any one make of shoe as the best. While there are on the market many shoes of various makes which adhere to certain fundamental principles, still there are such individual differences in feet that no one type of shoe will fit all. These differences are evidenced by the results of research on the part of the American Posture League, showing that normal feet are of three distinct shapes as to their "ground plan:" *Inflared*, *outflared* and *straight*.

The American Posture League describes them thus:

"These three types have no relation to whether or not the toes are turned inward, outward or straight ahead in standing and walking, or to whether or not the toes are bent from wearing shoes with 'pointed toes.' The type of foot may be understood by noting the relation of the broadest part of the foot to the center line of the heel carried forward, as shown in the illustration (Fig. 96).

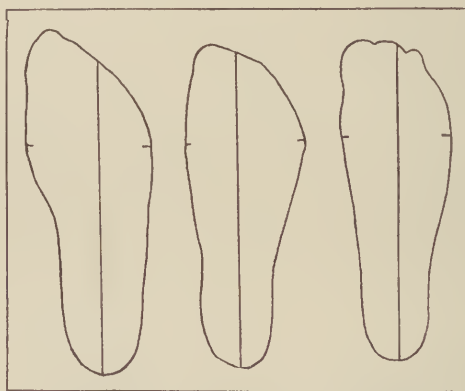
"*Inflared*.—If across the ball more of the foot surface lies *inside* of the line than outside, it is an inflared foot.

"*Outflared*.—If at the ball of the foot, more of the surface lies *outside* of the line than inside, it is an outflared foot.

“*Straight.*—If at the ball of the foot, the surface lies *equally on either side* of the line, it is a straight foot.”

Shoes fitting these types of feet would necessarily differ, for example, an inflated shoe, on an outflared foot would give uncomfortable pressure on the outer border and would cramp the little toe.

The natural foot, as has been stated, is broader at the toes than at the heel. Each one of the feet is triangular



Inflared.

Outflared.

Straight.

FIG. 96.—From illustration pamphlet published by American Posture League.

in shape, both together forming a substantial base of support for the body. The shape of the base given by the ordinary shoe is quite different and much less stable than that provided by Nature.

The *requisites of a good shoe* may be stated as follows:

1. Good appearance.
2. Straight inner border.
3. Wide shank.
4. Roomy upper.

5. Heel medium low and broad.
6. Toe not pointed.
7. Light in weight.

The advantage of the *flexible* over the *stiff* shank has been much discussed. Its value is obvious from the fact that it allows flexion of the foot at each step so that thus the strength of the muscles is maintained and the arch preserved. A stiff shank acts more or less as a brace and the muscles are not as active. The flexible shank, however, should not be arbitrarily advocated as the stiff shank may be advisable under certain conditions. In case a person is obliged to stand a great deal, the stiff shank will give the feet support and keep the arch from sagging, especially so, if the feet show some degree of weakness.

The *fulness of the "upper"* is an important feature of the shoe, as a tight upper binds down the toes, tends to depression of the arches and restricts motion. A tight seam over the top of the foot is likewise injurious in its effects, as it presses down the anterior arch.

A *low cut shoe* is preferable to a high one as it allows free action of the muscles and better action of the joints of the foot and ankle. If a high shoe is worn, it should be laced rather than buttoned, as the former allows better adjustment.

Stockings should be neither too short or too tight but well fitted and sufficiently elastic to conform to the shape of the foot. Otherwise they will act almost as a bandage, tending to constrict and hold the foot in a cramped position. The importance of well-fitted stockings in relation to their effect on the feet is not sufficiently appreciated. Some shoe manufacturers are now making right and left stockings, which give much more room than the ordinary type. It is interesting to note the Japanese stocking with its separate section for the great toe. Such a division is necessary to

accommodate the sandal-strap, and also places the first toe in a position to work to the best advantage in walking. A straight position of the foot is thus insured.

Children's Shoes.—Efforts at reform should be directed not only to the shoes of adults, but especially to those of children. Many shoes for the young have soles which are flat and stiff, with tight uppers which compress the feet, and hamper free action. Parents should understand the importance of procuring a shoe which is flexible, roomy and long enough to allow freedom of action for the growing foot of the child. With shoes for girls, the tendency is to begin early to raise the heels and point the toes. As this change is made during the period of growth while the bones are soft and pliable, the effect is most pernicious. It is not unusual to find girls during their adolescence with feet already deformed. The force of example is potent here. Girls of this age are susceptible to suggestion and see in the clothing and shoes of "grown-ups" desirable standards for imitation.

Results of Wearing an Ill-shaped Shoe.—A poorly fitting shoe, or one not adapted to the shape of the foot, produces local pain and discomfort as first results, and the unequal pressure also causes corns, calluses and bunions. The reaction upon the nervous system is considerable, and irritability and other mal-mental states, as well as fatigue, may often be traced to the shoes (Fig. 97).

The High Heels and Pointed Toes, which are characteristics of many of the fashionable shoes worn by women, are responsible for many evils. As the feet form the base of support for the body, it is essential that this base be a firm and comfortable one, otherwise the superimposed structure will suffer. If the bearing surface of the sole of the shoe is made smaller by narrowing the toe and diminishing the diameter of the heel, the support becomes less secure and it is impossible

that there should be as great activity or endurance (Fig. 98). By raising the heel, the foot is tilted, crowded forward into the toe of the shoe, the normal motions are lost, the foot is



FIG. 97.—The owner of this shoe and foot is a heavy woman, weighing nearly 200 pounds. Her feet are swollen, strained, have painful corns, calluses and bunions. She has chronic backache and exhibits extreme nervous irritability.

used stiffly, and the whole manner of walking is altered. Progression is made by flexion in the hip and knee-joints, these usually being held in a position of partial flexion, and there is diminished action in the foot and ankle-joints.

If a foot is held constantly in the position explained above, other adjustments follow. One of the most unfortunate of these is shortening of the tendo Achillis, the tendon of the great calf muscles (gastrocnemius and soleus), known also as the "heel cord." This restricts the motions of the foot in such a way that it may become a strong factor in the production or aggravation of a weak foot. It is often asserted that a low heel cannot be worn because the individual has a high arch. This is a fallacy unless the foot has become adjusted to a high heel. The so-called "high arch" is frequently the result of a short tendo Achillis which draws the ankle into a position of extension. The appearance of a high arch is given, when quite the reverse may be found if the foot is put in a natural horizontal position with heel and toe on the same level (Figs. 98 and 99).

The reason why women frequently assert that they cannot wear low heels is because the feet have become adjusted to high heels and when placed in an entirely new situation in regard to weight-bearing and activity, muscles and ligaments become strained and uncomfortable. It is inadvisable that any radical change should be too quickly made in the type of shoe. For instance, the substitution of a low heel for a high one, unless done gradually, would probably produce most uncomfortable if not painful conditions.

If the feet are normal, there is no reason why an occasional adjustment to higher heels and more pointed toes than are worn ordinarily would not be permissible and no harm result, but for the business of life, shoes which allow free movements of the feet and give a broad base should be urged.

Another factor which cannot be ignored is the almost constant danger from accident. Statistics show that in one year more than four thousand women in the United States were injured because of high heels.

Wearing shoes of the kind here under consideration would be bad enough if the injury were confined to the feet themselves, but the ill effects only begin with the feet; the adjust-



FIG. 98.—Position of foot in shoe with high heel and pointed toe. Short tendo Achillis, apparent “high arch” weight thrown on front of foot.



FIG. 99.—Position of foot in shoe with low heel. Tendo Achillis normal length. Arch the same, weight borne on whole foot.

ment of the whole body is disturbed by the change of position of the base of support; the knees and hips are thrown out of alignment, causing a change in the position of the pelvis, increasing the angle of inclination. As a result there are frequently displacements of the pelvic organs, muscle strain producing weak and painful backs, derangements of the nerves, and chronic fatigue. Poor postures of all sorts, flat chests, visceroptosis, and even lateral curvatures of the spine may likewise be traceable to this source.

SUMMARY.—The effects of wearing shoes with high heels and pointed toes may be manifested in the following ways:

1. Discomfort: Corns, bunions, etc.
2. Weak and flat feet.
3. Accident.
4. Decrease of working capacity.
5. Derangement of the nerves.
6. Displacement of organs.
7. Poor postures.

EXERCISES FOR THE FEET.

Terms frequently used, relating to the posture of the feet are “inversion,” raising the inner borders and “eversion,” raising the outer borders.

Exercises should be such as will strengthen the muscles which perform plantar flexion, adduction and inversion of the foot, and flexion of the ankle. The antagonistic muscles will need exercises to promote relaxation and stretching.

In *walking* naturally, with the body well poised, the heel strikes the ground first as the leg swings forward. Almost simultaneously, the weight of the body is carried along the outer border of the foot and transferred across the forward

part to the base of the great toe, by which it is propelled onward.

If the body is well poised and the chest elevated there will be continuity of motion, ease of carriage and elasticity of gait. On the contrary if one walks with the weight of the body over the heels, as is the case in poor posture, this continuity of motion is lost. A muscular effort must be made at each step to raise the body and to carry it onward; walking becomes a clumsy progression, a series of lifts and stops; elasticity of gait is wanting, fatigue is greater and frequently the joints are not fully extended, the ankles, knees and hips remaining in partial flexion and an extremely ugly appearance is the result.

1. One of the best exercises for the feet is the continual practice of walking with the feet slightly inverted and with the toes pointing straight forward.
2. Attention should be given to the establishment of a habit of standing with the arches drawn up with the weight on the outer borders, rather than allow the weight to bear down passively on a relaxed foot.
3. Exercises for correct walking, balance exercises, slow toe march and similar exercises are valuable both for the feet and for posture.

NOTE.—All standing exercises should be performed with the feet straight and about six inches apart.

4. Sitting. Foot circling.

Position.—Sitting. Cross one knee over the other, so that the leg hangs free.

Movement.—Extend ankle, pushing down with toes, then turn foot inward and upward, in a circular motion, flexing the ankle strongly.

5. Sitting. Ground-gripping exercise (Fig. 101).

Position.—Feet parallel on floor.

Movement.—Raise the arch by attempting to draw the toes toward the heel, turning the toes inward with



FIG. 100.—Correct walking. Students of Central School of Hygiene and Physical Education, New York City.

strong inversion. The same exercise may be done in the standing position.

6. Standing. Rise on toes. Then lower heels slowly with weight on outer sides of feet.
7. The "Grip Walk." Step forward with one foot. As the weight is brought forward, grip strongly with advanced foot. Relax grip as the next step is taken and repeat thus—"Step and grip, step and grip."
8. Stand on low stool or book, with edge just under the heads of the metatarsals.

Movement.—Strong plantar flexion of foot.



FIG. 101.—Ground-gripping exercise.

9. Endeavor to pick up small articles with the toes, such as a pencil, piece of chalk, or marble. Also grip a dumb-bell.

NOTE.—Numbers 8 and 9 are especially helpful for strengthening the anterior arch.

All these exercises should not be given at once. It is more desirable to choose two or three and practise them faithfully. To be of any value they must be done persistently two or three times a day and as many times as possible without undue fatigue.

If the individual is interested and will form the habit of drawing the foot into position frequently much improvement

can be made. This and the “ground-gripping” exercise can be performed while wearing the shoes—a distinct advantage.

Passive Exercises.—For weak or stiff feet it is sometimes advisable to use passive exercises, the same for either condition; but for the weak foot the exercises should be given gently, while for the stiff foot it should be done with considerable force. In connection with either condition, massage would be a great benefit.

The pupil should sit facing the teacher, who holds the foot in her lap, or the leg may be extended on a plinth or couch. The teacher then grasps the ankle firmly, behind the heel.



FIG. 102.—Exercise to stretch a short tendo Achillis.

1. *Forcible Plantar Flexion of the Foot.*—Grasp the toes and bend downward at the metatarso-phalangeal joints.

2. *Plantar Flexion with Adduction and Inversion.*—Start as in number 1. Bend toes downward then turn foot upward and inward.

3. *Flexion of Ankle with Adduction and Inversion.*—Add to exercise number 2, a strong upward push on the sole of the foot, holding the heel firmly to prevent flexion of the knee. This is an excellent exercise for stretching the tendo Achillis.

ACTIVE EXERCISES FOR A SHORT TENDO ACHILLIS.

1. Walk on the heels, with the feet straight, toes raised.
2. Stand. Let the body fall forward from the ankles until

supported diagonally by the hands, which are placed at shoulder height on wall or other upright.



FIG. 103.—Showing difference in size of base furnished by a broad sole and heel and by a narrow toe and high heel. (From actual drawings.)

3. Stand. Heel on floor, toe elevated against a block, or some firm support. Sway body forward until a pull is felt on the cord. This is performed with one foot at a time (Fig. 102).

FOOT EXERCISE GAMES.

For the purpose of arousing interest, especially with children, the necessary elements in foot exercises can be embodied in simple games. A child will work more intensively and longer with the game as an objective.

1. Competitive foot race.

Walking a stated distance on the outer borders of feet.

2. Competitive marble game.

Picking up marbles with toes and placing them in a receptacle. Each pupil is given an equal number, and each foot must be used the same number of times.

3. Foot-writing.

Grasp a piece of chalk with the toes, and with foot inverted with the outer border toward the floor, endeavor to write the name.

4. Competitive "tit-tat-toe" game, with chalk, on the floor.

5. Competitive game with checkers.

Grasp checker with toes and place on board. The child placing all his checkers first, wins. (Checker boards can be purchased at the ten cent stores.)

6. The "Foot Juggler."

Two pupils lie on their backs on the floor. The legs are extended upward, and a large ball is held on the soles of feet. The ball is to be tossed and caught on the feet. The one keeping the ball in action longest, wins game.

With the exception of number 4, these can be done alone, as well as in competition.

CHAPTER XIII.

INFANTILE PARALYSIS.

INFANTILE paralysis is one of the most baffling and dreaded of the diseases of childhood. Although it also attacks adults occasionally, it is among children that the majority of cases are found, and it seems equally prevalent in all classes of society.

The term anterior poliomyelitis is a more technical name for the disease because the chief seat of the affection is in the anterior columns of the spinal cord, but the term infantile paralysis is used much more generally by the laity.

It occurs usually as an epidemic form of disease, which seems to be increasing in this country. The most recent of these attacks was the one which swept over the East in 1916, and was especially violent in and around New York City.

For many years, research work has been carried on unceasingly in experimental laboratories. State boards of health have spent large sums of money for purposes of investigation, and in sending corps of physicians to the communities affected in endeavors to find their probable source or sources of infection. All conditions of environment have been noted, and suspicion has been directed toward many kinds of insects, animals, food, water supply, sewage, dust and so on, but no definite conclusion has been reached.

Conditions pertaining to hygiene should be controlled as far as possible for the reason that they appear to be contributory to this as to any other infectious disease, and they are also probable factors in the spread of the evil. One important

fact concerning it has been established: namely, that it is readily communicable, not only by the person having the disease, but also by the "healthy carrier." In a report of the research work of the Rockefeller Institute, the statement is made that "epidemic poliomyelitis has been clearly observed to follow the lines of human contact and travel."

There should be for several weeks strict isolation of a case and of those who have been exposed, and attendance at school especially, should not be allowed for some time. During the epidemic in New York the schools were closed and many of the theaters and public resorts excluded children. Quarantine measures were adopted and lines of travel to and from the city were carefully watched in order that the community might be safeguarded from possible "carriers."

It staggers the mind when one reads in the report of the New York State Department that "approximately 9023 cases of poliomyelitis were reported during 1916. The mortality was about 25 per cent, leaving approximately 6755 cases, of which by far the greater number required after-care treatment." The aftermath in the hospitals was a pitiful sight, for a large proportion of those afflicted, even under the best possible treatment, were disabled to some degree.

Investigations have proved that anterior poliomyelitis is an infectious disease, produced by a tiny virus which is tough and resistive to many destructive measures. Its entrance to the body is through the digestive and respiratory tracts, more frequently through the latter by way of the nose and throat. Then circulating in the blood stream it causes toxic changes which injure the nerve cells, especially those of the anterior horns of the spinal cord. As these cells are in the roots of the motor nerves that supply the muscles, stimulating them to action, the part of the cord affected and the amount of destruction taking place will determine the areas

and extent of paralysis of the muscles. Sometimes the injury to the nerve cells is slight and consequently the repair may be complete. In such a case the individual recovers entirely. However, more frequently there is considerable injury, the repair is less and the recovery of muscular action is limited. It not infrequently happens that entire destruction of the nerve cells has taken place, influencing more extensive muscular areas, resulting in those hopeless cases of paralysis that can never be improved.

The *age* at which infantile paralysis is most liable to occur is between two and three years. Statistics show that 71 per cent of the cases are found in the first five years of life and 87 per cent in the first ten. After ten years of age its occurrence is less frequent. From the ages of eleven to twenty years it drops considerably, but even to the age of forty or forty-five years there may be an occasional appearance. It seems to attack the sexes equally, but the individual who has been once afflicted is immune to further attacks.

SYMPTOMS.

The symptoms are similar to those of any infection and there is nothing to distinguish its onset from any of the so-called "children's diseases." Usually there is a slight feverish attack. There may also be digestive disturbance or sore throat, or it may be thought that the child has a cold, and in this stage diagnosis is rarely made as the paralysis does not occur at once but usually at a period of from one to eight days. There is considerable tenderness in some cases.

TREATMENT.

During the acute stage of the disease the patient should be kept quiet in bed and care be taken to prevent if possible

the beginnings of deformities which might occur from wrong positions in bed or even from so slight an influence as the pressure of the bed-clothing.

After the acute stage has passed and all pain and tenderness have subsided, treatment should be commenced for the *restoration of muscular power*, and for prevention of deformity. The time within which it is possible to regain muscle power varies in different cases, but treatment should be persisted in for at least two years. Some recover quickly, others more slowly, and may never regain full power. If the respiratory centers have been paralyzed death ensues.

Treatment of the *prevention of deformity* should be continued during the period of the growth of the child so that contractions may be prevented and scoliosis avoided or minimized. The need of early care in the prevention of lateral curvature of the spine must be borne in mind. General muscular weakness, the unequal tone of the muscles, asymmetrical modes of walking, or one-sided use of the arms, tend to produce or exaggerate this deformity. *Some of the worst cases of scoliosis* are of paralytic origin. Deformities of the limbs also occur from the unantagonized pull of the muscles, when the opposing groups have been affected.

Operative Treatment.—Many operations are performed for the improvement of function and for the establishment of greater stability. Tendon transplantation has been used extensively and in many cases with much success. It consists in connecting the tendon of the affected muscle with that of an uninjured one in such a position that the latter will perform the function of the muscle which has been paralyzed. Nerve transplantation has been used somewhat but without much success. Tendon lengthening and shortening are both of value in allowing either more or less freedom of motion to

joints. Arthrodesis, or the surgical fixation of a joint, is sometimes performed.

Electricity.—Although electricity has been quite generally employed in the treatment of infantile paralysis, nevertheless its use is now a subject much discussed and strong arguments as to its lack of value have been advanced.

Heat.—This is useful for giving artificial stimulation to the parts affected and in helping nutrition of the tissues by increasing the circulation. This form of treatment can be given by means of various sorts of apparatus, from the electric “baker” for radiant heat, in the office of the specialist, to the humble oven in the kitchen of the home. Hot water is sometimes used, or preferably hot sand, in which the part affected is immersed.

Massage.—Massage is of value in stimulating the circulation and in toning up the muscles, but it has no effect whatever upon the reestablishment of the neuro-muscular control. Care must be taken that the manipulations are not too hard or too long continued, as in such case the muscles will become overtired.

None of the above-mentioned methods of treatment should be used alone, since they are of value only as they stimulate the circulation and improve the tone of the tissues. But they may be employed as useful adjuncts to the important feature of the treatment, viz.:

Muscle Training.—The value of muscle training cannot be overestimated, as it makes necessary the effort of the individual to send motor impulses down unused paths, thereby reestablishing the lost or forgotten neuro-muscular control.

It is important that the individual should be alone with the teacher for treatment so that attention shall not be diverted, for powerful concentration is necessary in order to

accomplish any result. The teacher must encourage and stimulate effort in every possible way. The part to be exercised should be uncovered.

In the beginning, if excessive contractions have occurred in the opposing groups, it will be advisable to passively stretch the shortened tendons. This must be done carefully so that resistance will not be offered through the patient's fear of being hurt. With flaccid or very weak muscles it will be necessary to begin with passive exercises, and during the performance of these the child is asked to make an effort. When even the slightest response comes, the exercise becomes assistive, the teacher guiding and helping less and less until the ability to perform an active movement is established. In some cases the work may be carried still further and resistive exercises given.

Training before a mirror is excellent, especially so for the leg paralyses, as the individual can be trained to make the proper coördinations in walking by repeated observation of himself in the mirror.

It is important that the exercises shall not be continued so long a time that the muscles become fatigued. It has been proved that serious harm is often done in this way. By too zealous effort to produce results, the weakened muscles have been overtired, and thus still further weakened. All exercises must be done slowly and carefully to the extreme of the movement, and they must be repeated day after day for a long period. Great patience and courage are needed, for in the majority of cases results come very slowly.

In the regular routine of the teacher of individual gymnastics the treatment of infantile paralysis in all probability will be confined to an occasional case. A thorough understanding of anatomy and kinesiology is essential for the

proper application of treatment, and the teacher should work under the direction of an orthopaedic surgeon.

In a book of this sort, it would be inadvisable to lay out a plan of exercises, and the aim of this chapter has been to indicate conditions only in a general way, and to recommend, for further enlightenment and help, the best authority on the subject.¹

Braces.—Braces are used in connection with the treatment:

1. To correct deformities.
2. To prevent development of deformities.
3. To aid in locomotion.

Braces should not be worn any more than necessary but only as an adjunct to the treatment, excepting in the more severe cases, where the disability or deformity is extreme. They should be simple and light in construction, and adjusted so as not to impede the circulation. They should be fitted under the direction of a specialist.

¹ Lovett: *Treatment of Infantile Paralysis*, Blakiston, Philadelphia, 1916.

CHAPTER XIV.

CONSTIPATION—DYSMENORRHEA.

CONSTIPATION.

ONE of the functions of the body most essential for its well-being is the elimination of waste matter through the intestines. If this is not done with frequency and regularity, constipation results, and this condition is so prevalent that it clearly proves the fact that the importance of this function is underestimated and even ignored by many people.

The formation of poisons in the residual matter of the intestines soon causes a toxic condition throughout the body, and is the cause of many ills.

It is noteworthy in this connection and also most significant that when the advice of a physician is sought—whether it be for a cold, a headache, or perhaps some more serious illness, ailment or disease, one of the first inquiries made by him concerns the patient's condition as to constipation, and almost invariably a cathartic is prescribed as the initial measure in the treatment.

Causes.—Constipation may be the result of poor posture or a ptosis—both of which, as has been seen, affect the tone and strength of the abdominal walls and results in the sagging and imperfect functioning of the enclosed organs. It may also be due to improper diet or too small an intake of water, lack of exercise or to careless habits. One or all of these factors may participate in the causation of this troublesome affliction, and unless steps are taken to remove the cause, constipation becomes chronic.

Treatment.—*Habit.*—There should be a natural and complete evacuation of the bowels every day. The ideal would be twice a day, morning and night. This is largely a matter of habit and should be cultivated and rigidly adhered to at a regular time daily. No pressure of other duties or any excuse whatsoever should be allowed to interfere. Too much stress cannot be placed upon the importance of forming this habit. The vital necessity of establishing it as a part of the daily routine should be instilled into the minds of children at an early age and its regularity insisted upon.

It is also an essential consideration that it is possible to have a movement of the bowels every day and yet to be constipated. In such case the evacuation is not complete, and the residual waste matter constitutes a veritable poison center to which many bodily ills may be traced. It is a wise measure for everyone, admitting the possibility of such a condition, to take a mild cathartic periodically for the purpose of thoroughly clearing the intestinal tract. For this some of the laxative mineral waters are excellent.

Diet.—In the treatment of constipation diet is important. Some coarse food, plenty of green vegetables and fruit should be included in the daily menu, which may follow in a general way such an outline as is given herewith:

Breakfast.—Fruit; cereal (preferably coarser varieties), such as oat or corn meal. The cooked cereals are best, although shredded wheat is good. Bran, either alone or with another cereal, is recommended. Eggs can be added to the breakfast and coarse bread with plenty of butter.

Luncheon.—Simple salads; green vegetables or fruit; coarse bread and butter.

Dinner.—Thin soup; meat or fish; two sorts of vegetables (spinach is appetizing and healthful); salad; coarse bread. Almost any sort of dessert desired may be added excepting pastry.

Water Drinking is Important.—On arising a glass of water should be taken—some physicians advise cold water rather than hot as being more stimulating. Between breakfast and luncheon take two glasses, also two between luncheon and dinner, and one at least before retiring. A glass may be taken at each of the meals if desired, but not with the food. If not taken at meals, more should be taken between meals, and the quota for the day ought to be six glasses or more. The establishment of a habit of drinking plenty of water is one of the greatest of the aids to health.

Massage is useful in the treatment of constipation, especially in chronic conditions. It stimulates the peristaltic action and mechanically loosens any hard waste products in the intestines and passes them onward. The direction of the course of the large intestine must be followed, starting from the right side of the groin, up, across the abdomen, above the umbilicus, and down toward the rectum on the left side.

Treatment by Exercise.—In no condition is exercise more sure in its results than in the treatment of constipation. It is the stimulation to “peristaltic action” that is the purpose of exercise. However, there must be persistent and long-continued effort, aided by attention to other hygienic measures, such as have been previously indicated.

There should be borne in mind the muscular structure of the organs of digestion, and also the fact that their functions are performed by the action of their muscle fibers. If the tone of the muscular walls of the intestines is poor,

their action will be sluggish, a condition of stasis results and the waste matter is not passed along and discharged from the body.

The effect of exercise upon constipation is well formulated by Gant, who says substantially that:

The *first* effect is to stimulate the processes of absorption, nutrition and elimination by increasing the general circulation. The *second* effect is to increase the peristaltic action of the intestines by assisting in a more speedy removal of the carbon dioxide. The *third* effect is the increase of respiration and is considered the most important. The deeper breathing causes the diaphragm to work more actively, and its descent being greater and stronger a definite massage is transmitted to the digestive organs. The *fourth* value is that the glands of the pancreas, liver and intestines, which secrete the digestive fluids are stimulated, causing them to pour forth their secretions more abundantly, and soften the waste matter in the intestines. The *fifth* effect is the lessening of auto-intoxication in the elimination of the waste matter from which poisons are absorbed into the blood. The improvement of the general muscular strength through exercise is the *sixth* effect, and the *final* reason given is the improved action of the intestines through the stimulation of the nerves.

EXERCISES.

If there is a condition of poor posture or a ptosis in connection with constipation, exercises for correction should be given as before indicated.

1. Lie on the back; legs extended. Draw knees to chest alternately making considerable pressure on the abdomen, giving additional pressure by clasping the hands across the abdomen. Slowly—6 to 10 times with each leg (Fig. 104).

2. Lie on the back; legs extended; draw knees upward on the right side swing across abdomen, when drawn up, from right to left, keeping the hips as immovable as possible. Then extend the knees slowly, letting legs return to first



FIG. 104.—Knee-pressure exercise for constipation.

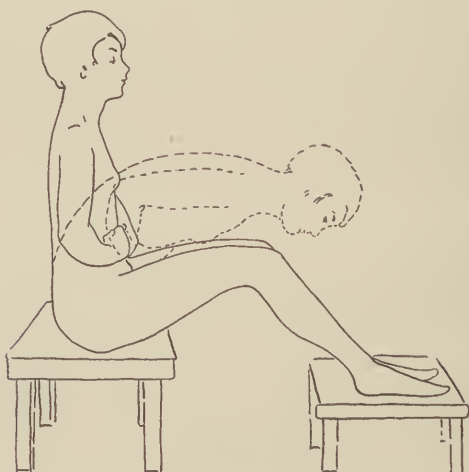


FIG. 105.—Forward bending exercise for constipation.

position. Five times. (This is for stimulation of large intestine.)

3. Lie on the back. Draw both knees to chest, then circle them together first to right, then to left side. Five times each side.

4. Sitting. Hands clasped over abdomen. Feet elevated. Bend forward as far as possible making pressure on abdomen, 10 times or more. (Fig. 105.)

5. Sitting. Hands on hips; trunk circling. (See Fig. 63, p. 140.)



FIG. 106.—Mat-treading exercise. (Position.)

6. Make voluntary contraction of the abdominal muscles, either standing, or lying on the back, with knees bent up.

7. Standing. Bend knee to chest and return to position. Repeat with other leg, 10 to 20 times.



FIG. 107.—Mat-treading exercise. (Movement.) For strengthening abdominal muscles.

8. Mat-treading exercise. (See illustration, Figs. 106 and 107.) From the "Knee-elbow" position—extend legs alternately, allowing trunk to extend also. Excellent for general strengthening of abdominal muscles.

Exercises inducing deep breathing are useful because the downward motion of the diaphragm presses upon the organs of digestion and stimulates them to activity.

DYSMENORRHEA.

Normally women should not be incapacitated or experience pain at the menstrual period, for with them this is as natural a function of certain organs as is that of any other organ of the human system. The fact that many of them are so affected and suffer from dysmenorrhea or painful menstruation is well known and may be traced to several causes.

If a woman is to take her rightful place in the professional and business world, she cannot, from an economic standpoint, afford to neglect the correction of this condition. It is a problem which should be met squarely. There must be no expectation of special consideration at these periods of adjustment of work, so that she may be periodically excused from duty. Loss of working capacity from this cause has been one of the strongest arguments against the relative value of women as compared with men employees. There is no reason why a woman cannot, by attention to the matter, remove causes so that the function may be almost entirely disregarded. This does not, of course, apply to conditions of more serious underlying organic causes such as displacements.

If the dysmenorrhea does not disappear after a reasonable time, during which there has been a regulation of the hygiene and attention to proper exercise, the condition should then be investigated by a specialist.

Causes.—A discussion of the causes of this condition necessarily involves a consideration of some of the erroneous beliefs which formerly existed and which are prevalent to a certain extent even at the present time. Among the many traditions which have hampered women in the past there is probably none which has been more persistent nor which

has exerted a more weakening influence upon her physical and mental hygiene, than that which has caused the function of menstruation to be regarded as an illness and a time when the normal habits of living should be altered.

Apprehension of pain, expectation of disability, concentration upon the period, lead to undesirable morbidity and start a "vicious circle" of mental and physical depression and abnormality. It is incumbent upon those who are in charge of girls and young women to normalize this attitude, to readjust the mental focus, and to teach the importance of health habits which shall result in the prevention and remedy of excessive periodic disturbances.

The idea that bathing at this time is injurious has been placed among the false traditions, and it is now generally accepted that the warm bath is not only permissible, but advisable.

The tendency to diminish the accustomed amount of exercise has been very general, and its result has been bad, as the organs become congested and their function interfered with. Further attention will be given to this matter later on.

Constricting clothing, especially tight bands and corsets, which exert a downward pressure on the pelvic organs, are factors of evil. Shoes with high heels are pernicious in their effect and a frequent cause of displacements of the uterus as well as of dysmenorrhea, since the tilting of the pelvis which results allows the organs to be thrown out of their normal, into a position of strain. Poor posture and visceroptosis, both of which are accompanied by weak abdominal muscles and sagging of the organs, may also be included as prevailing causes.

One has only to keep in mind the close relation between the abdominal and pelvic organs to understand that constipation and dysmenorrhea are companion miseries because

of the pressure of the distended intestines, especially of the rectum, upon the uterus, and that the relief of constipation frequently means the relief of dysmenorrhea.

These causative factors are one and all within the control of every woman, and, except in specific cases, if the dysmenorrhea persists the individual is reprehensible, for any woman with sufficient vision and will-power can adopt a sane mental attitude, acquire strong muscles and a good posture, normalize her health habits, adjust her clothing and shoes and correct constipation. Menstrual irregularities are largely due to the same causes and yield to the same treatment.

Advisability of Exercise.—A subject under much discussion is the amount of exercise which should be taken at this period. Regular activities should be carried on as a matter of course. Walking is beneficial. In the gymnasium the work may be continued, but modified at the discretion of the teacher. It should be possible for the average student to perform all but apparatus and heavy abdominal work. Exercise for the arms, legs, trunk and those stimulating respiration and the action of the diaphragm are advisable. With students in normal schools of physical education the gymnastic work should not be discontinued except in special cases.

The following plan has been tried out satisfactorily not only with the above-mentioned group, but with students in several of the colleges for women. During the period, the student reports for work in the individual gymnastic room, being excused from the regular class for the purpose, and carries out a special program of exercises, under supervision. Some students may be allowed a more vigorous program, than others, and the individual programs may vary from day to day.

The results of a program of this sort with a group of stu-

dents under the observation of the writer have been gratifying. The conclusions reached were based on data compiled by the individual students. A book was provided in which each student was asked to record in the form of a diary, on sheets especially prepared for the purpose, the date, duration of period, prodromal symptoms, pain, a list of exercises taken, effect of exercise and "remarks." The result of these records showed normalizing of function in practically every case; shortening of length of period where it had been of too long duration, diminution of pain and lessening of mental depression. There had been no ill effects experienced from the exercises, in fact a frequent comment was that of "feeling better" afterward.

In addition to the beneficial effect of the exercises in relieving congestion and strengthening the muscles, there is a psychic value in continuing exercises. The mental attitude produced is distinctly different from that under the suspension of all exercise and where a line of demarcation is drawn, which impresses the girl with the idea that there is a periodic time when activity should be discontinued, and she is more or less "abnormal."

Treatment.—As before indicated, the treatment of dysmenorrhea and menstrual irregularities is primarily the establishment of rational thinking and living and a reasonable amount of physical exercise.

Specific Exercise.—The "Mosher exercise," originated by Dr. Cleila Mosher, of Leland Stanford Junior University, is so beneficial and simple that it should be practised daily by every woman. The exercise is described by Dr. Mosher¹ as follows:

"All tight clothing having been removed, the woman is placed on her back on a level surface, in the horizontal posi-

¹ Mosher: Health and the Woman Movement.

tion. The knees are flexed and the arms are placed at the sides to secure perfect relaxation. One hand is allowed to rest on the abdominal wall without exerting any pressure, to serve as an indicator of the amount of the movement. The woman is then directed to see how high she can raise the hand by lifting the abdominal wall without straining, then to see how far the hand will be lowered by the voluntary contraction of the abdominal muscles, the importance of this



FIG. 108



FIG. 109

FIGS. 108 and 109.—Illustrating "Mosher" exercise.

contraction being especially emphasized. This exercise is repeated 10 times night and morning in a well-ventilated room, preferably while she is still in bed in her night-clothing. She is cautioned to avoid jerky movements and to strive for a smooth, rhythmical raising and lowering of the abdominal wall. These exercises should be taken twice daily every day in the month, including the time of menstruation. The bladder should be emptied before the exercises are begun.

The exercises must be continued over a considerable period of time to accomplish any very striking results, long enough to develop these muscles and to establish their more or less constant use without conscious effort."

TYPICAL PROGRAM OF EXERCISES.

1. General relaxation exercises.
2. Posture training.
3. Lying on mat. Feet on floor; knees bent. Vigorous arm extensions upward, sideways and forward.
4. "Mosher exercise" (10 times only).
5. Stride sitting. Trunk bending sideways (Fig. 52).
6. Stride sitting. Trunk twisting (Fig. 50).
7. Knee-chest position.
8. Balance exercises, walking in good posture.
9. Hook lying (position as in Exercise 3). Relaxation and deep breathing.

CASE RECORD.

History.—Young woman, aged twenty years. Entered school of physical education in September. Posture poor; marked ptosis; periods irregular with pain; examination by specialist showed retroversion of uterus.

Treatment.—Exercises prescribed:

1. "Mosher exercise" (Fig. 108).
2. Knee-chest position (Fig. 67).
3. Knee-chest position with leg-raising.
4. Sitting. Trunk circling.

These were performed five minutes twice a day at first; the time increased to ten minutes.

Also regular work was done in the gymnasium with special attention to posture.

Result.—Improvement began to be noticed after two months, steadily increasing. After eight months, regularity of periods had been established, pain had been reduced to a minimum; posture improved and a second examination by specialist showed normal position of uterus, and no retroversion.

CHAPTER XV.

OVERWEIGHT AND UNDERWEIGHT.

OVERWEIGHT.

THE tendency to obesity is a specter which haunts the footsteps of many people, and the teacher of physical education is consulted frequently in regard to methods of preventing or reducing an accumulation of fat.

Statistics formulated by life insurance companies show that underweight in the young is more detrimental to the well-being of the individual than overweight, but the overweight is a much less favorable condition in the middle-aged and elderly, and is associated with a higher death-rate.

Obesity is due to overnutrition and underoxidation of the tissues, or, in other words, is the result of more food than is necessary either in amount or kind, and of too little exercise. The result is that fat is deposited, muscles deteriorate, energy diminishes, and even the mental powers are dulled. The functions of the vital organs become sluggish, and the tax upon the heart is increased. These conditions tend to slow down the bodily activities, hasten old age, decrease the resistance, and so shorten life. "Weight in relation to age is an important factor in influencing longevity."¹ Besides the above stated disadvantages there is definite physical discomfort when the size of the body becomes a burden.

Some individuals are more prone to overabundant flesh than others, as there is an inherited predisposition to follow

¹ Fisher and Fiske: How to Live.

type. These are usually people of a placid, easy-going temperament, who have a disinclination to take much exercise. The fat accumulates insidiously, especially in those regions where there is little muscular activity, as for instance around the waist, abdomen, hips, shoulders and neck. In many cases there will be excess fat around the internal organs, and fatty degeneration of the heart frequently occurs.

Treatment.—Exercise is an important agent in the treatment of obesity: However *it is not sufficient of itself alone* but must be accompanied by regulation of the diet, and in many cases this means rigid self-denial. If there is a determination to follow a program embodying vigorous exercise and restriction of the diet, the results will be gratifying in the extreme.

Before entering upon a course of treatment the general strength of the pupil must be noted and the heart tested, as of necessity exercises should be vigorous and of such character as will induce perspiration.

The process of reducing the weight should be gradual, for it is weakening to reduce too rapidly, especially for older people. The treatment must always be regulated to the individual with reference to age, temperament and any existing physical abnormality; the pulse should also be taken before and after exercise and the amount of fatigue noted. Care must be exercised not to overtax the heart, and a heart examination by a physician should be insisted upon previous to undertaking a program for reduction.

Drugs should be avoided, except in extreme cases, and then taken only upon the advice of a reliable physician. Many of the advertised cures for obesity are disastrous in their effects, being frequently of such a nature as will disarrange the processes of assimilation and digestion, if they do not lead to more serious results.

Regulation of the Diet.—If possible, it is well to have the advice of a physician in regard to diet. In general, it may be said that nearly everyone eats too much and that restraint may be all the advice necessary in some cases where the condition is not extreme. There should be no eating between meals; the quantity of sugar, fats and starch should be diminished. The menu should contain a greater proportion of bulky foods, which are less in caloric value, and salads and fruit in abundance; the temptation to indulge in candy and desserts should be met with fortitude.

It is wise to prescribe the diet carefully in the more extreme cases, in order that the food may be of sufficient caloric value, for when left to the judgment of the individual the food selected may not have the requisite nutrient values. Dieting of itself alone is inadvisable, since it produces weak and flabby muscles and is exhausting.

A program of exercises should embody both general and local work and be so arranged that maximum activity is in the middle of the lesson and gradually slowed down to the end. Some of the specific exercises for localized action of the abdominal and trunk muscles have been described in Chapter VII. Note Exercises, Figs. 40, 46, 47, 50, 52, 53, 56, 58, 61, 63.

The exercise heel raising, knee bending, with arm raising sideways is useful as a general exercise.

The practice of drawing the abdomen in by voluntary contraction of the muscles should be advised.

For a flabby chin, head bending backward, head bending sideways, head twisting and rotation.

For back of neck (prominence of seventh cervical). This unsightly lump accompanied by an accumulation of fat, is difficult to remove, but it can be accomplished by persistent exercises of the following type:

1. Draw head horizontally backward, drawing chin down (Fig. 58).
2. Arms forward bent at level of shoulders. Fists clenched. Draw arms and head slowly and forcibly backward.
3. Bend trunk slightly forward from the hips. Extend arms slowly sideways from the shoulders, keeping head back.
4. Deep massage is helpful also.

TYPICAL PROGRAM FOR OBESITY (WHERE THERE IS NO HEART DIFFICULTY).

1. A quick run around the room, or stationary running.
2. Relaxation and deep breathing.
3. Sitting. Trunk-twisting and bending. (See Figs. 50 and 52.)
4. Arm and leg flinging on the mat (Fig. 40).
5. "Jumping-jack" exercises (Fig. 24).
6. Knee-bending, lying on the mat (Fig. 58).
7. Prone standing. Slow arm extension sideways.
8. Standing heel-raising and knee-bending, with arm extension sideways.
9. Aëroplane exercise (Fig. 46).
10. Practise walking in good posture, with abdomen retracted.
11. "Mat-treading" (Fig. 103).
12. Hook lying. Deep breathing.
Relax, and rest.

Exercises should be performed in a room with free circulation of air and the pupil should always be encouraged to breathe deeply and freely at all times.

UNDERWEIGHT.

The condition of underweight may be the result of several underlying conditions and in most cases can be improved by exercise.

As in obesity there is often an inherited tendency and a corresponding temperamental propensity to nerve-tension and overactivity.

Imperfect assimilation of food is a frequent cause as are also severe mental exertion and worry.

Treatment.—Underlying conditions should be carefully investigated by inquiring into the daily life of the individual and ascertaining not only if the occupation is such as may produce excessive fatigue, physical or mental, but also whether or not there are cares and worries, and if proper rules of hygiene are being observed. The regulation of these conditions is a necessary feature of the treatment.

In the individual who is underweight the tissues are not sufficiently nourished, the muscles have become weak and flabby, and the output of energy being greater than the supply there is overtaking of the organism and chronic fatigue. There is a probability that the food is insufficient in nutritive value, or is not properly digested or assimilated. It follows, therefore, that attention to diet and digestion is important in the treatment.

It will be noticed that people who are underweight are often precarious in their appetites and should be encouraged to regulate and increase their diet, and to include therein foods containing liberal amounts of starches, sugars and fats. Other essentials are: drinking plenty of water, and obtaining sufficient rest and sleep.

Exercise is very beneficial, as it improves the general circulation, stimulates the activity of the digestive organs and thereby assists assimilation and regulates the metabolism.

It should also aid powers of relaxation and be restful to the nerves.

Exercises should be given slowly and not too vigorously at first; they should be such as to arouse the interest, and much attention should be given to relaxation. The use of a victrola is very helpful in work of this nature as it helps to make the individual less subjective and enables one to perform the exercises with less tension.

Some of the simple class exercises in the repertoire of every teacher of physical education may be used in planning a program to meet these needs.

It is usual to find a condition of constipation, and two or three specific exercises should be included in the program.

Care must be taken to begin with a simple lesson and not overtax the pupil. It is wise to give exercises in the recumbent position almost entirely if there is little physical strength. The pulse should be noted.

PROGRAM OF EXERCISES FOR UNDERWEIGHT.

1. Relaxation exercises.
 2. Deep breathing.
 3. Training for posture.
 4. Lying on the mat. Knees bent, feet on floor. Slow arm flinging in various directions.
 5. Lying on mat. Legs extended. Alternate leg raising.
 6. Sitting. Trunk bending and circling. (See Chapter VII.)
 7. Bicycle exercise.
 8. "Mosher exercise" (Figs. 108 and 109).
 9. Lying on back. Extending dumb-bells sideways (Fig. 31).
 10. Relaxing exercises in standing position.
 11. Walking in good posture.
- Rest and relax.

CHAPTER XVI.

INDICATIONS FOR EXERCISE IN ABNORMAL HEART AND THYROID CONDITIONS.

This short chapter has been added because of the many inquiries by teachers and students of physical education as to the advisability of exercise for pupils exhibiting either a heart weakness or an abnormal condition of the thyroid gland. If exercise be deemed advisable, the succeeding questions are as to the type of exercises, and the amount of responsibility which may be assumed safely by the instructor. It will be the purpose here to answer briefly these questions and to indicate lines of procedure.

IN GENERAL.—Both conditions can be benefited by exercises carefully graded and intelligently applied.

A medical examination with the subsequent diagnosis and advice of a physician must always be the basis of any procedure by the instructor in the planning and application of an exercise program.

ABNORMAL HEART CONDITIONS.

1. *Aims of Exercise.*

- (a) Improvement of the peripheral circulation.
- (b) Strengthening the heart muscle.
- (c) Deepening the respiration.
- (d) Normalizing the action of the cardiac nerves.

2. *Exercise tolerance.*

The pulse should be taken both before and at the end of the exercise period, and a return to normal or slightly below, after a short rest, would be an indication that the demand upon the heart had not been excessive, but within the tolerance of the individual.

3. *Character of Exercises.*

Exercises should be of the type not demanding forced or sudden effort, or be of prolonged duration. They should be of a general character: simple arm and leg movements are excellent, given at first in the lying or sitting position. Rhythmical exercises are valuable. As joint action is most beneficial in its effect upon bloodvessels, even the simplest flexions and extensions of the joints can be used.

No exercise should be given in the hanging position, or with arms extended over the head, although exercises of this type may be reached in progression as the condition improves.

4. *Supervision.*

Careful supervision is necessary. The pupil should be watched for indications of fatigue or over-exertion, some of the signs being cyanosis, sighing, breathlessness, and palpitation. Also, holding the breath must be avoided.

5. *Progression.*

There should be steady progression, and the exercise tolerance increased as rapidly as possible. Much depends upon the discernment of the teacher and the correct application of the exercises. The results reached in the experience of the author and of others, in the improvement of these conditions through exercise have been most gratifying and the progress made in many cases almost astonishing.

The value of exercise in the relief of heart difficulties is being increasingly recognized. In this connection the well-known methods of Schott and Oërtel should be mentioned. The Schott system consists of carefully graded resistive exercises combined with mineral baths, the original being at Bad Nauheim, and the treatment known as the Nauheim method. The Oërtel system is, briefly, the improvement of the heart by mountain climbing, with a regulation of diet.

THYROID ABNORMALITIES.

Physical examinations of individuals in schools, colleges, and other institutions by doctors and physical education teachers are revealing a surprising number of abnormally functioning thyroid glands. In some sections of the country this situation is more extreme than others. The question arises here also as to the benefit which may be derived from exercise. As before stated, certain types of exercises are helpful, but a previous medical diagnosis should be insisted upon.

The two types of abnormal conditions are the hypothyroid, and the hyperthyroid. In either case the exercise treatment is the same, the object being to normalize the secretion of the gland, and to bring the individual up to a better general condition.

Medical Treatment.—It may be desirable in addition to the exercises, to help improve the condition by the administration of iodine, but this should always be done upon the advice of the physician. This treatment is being given in some localities as a routine preventive measure, where goiter is endemic, with successful results.

Exercises.—Much the same procedure should be followed in the planning and application of exercises for the abnormal

thyroid conditions as for the heart. Exercises of a general character, not too taxing, should be chosen. The progression should be gradual and as rapid as possible. There is often a tendency to abnormal self-consciousness which it is desirable to minimize.

No exercises necessitating tension in the neck should be given, or strenuous head and neck movements. Many of the enlarged thyroids are called "postural," as an improved posture of the head in these cases, relieving pressure on the glands, results in a diminution in their size.

There is often a tendency to a weak heart as an accompaniment to these conditions which the instructor should bear in mind when planning exercises.

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